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THE AFTERMATH OF APPRECIATIONS

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ABSTRACT

This paper empirically analyzes a broad range of real exchange rate appreciation episodes. The cases are identified after compiling a large sample of monthly multilateral real exchange rates from 1960 to 1994. The objective is twofold. First, the paper studies the dynamics of appreciations, avoiding the sample selection of analyzing exclusively the crisis (or devaluation) cases. Second, the paper analyzes the mechanism by which overvaluations are corrected. In particular, we are interested in the proportion of the reversions that occur through nominal devaluations, rather than cumulative inflation differentials. We calculate the probability of undoing appreciations without nominal depreciations for various degrees of misalignment. The overall conclusion is that it is very unlikely to undo large and medium appreciations without nominal devaluations.

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1 Introduction

One of the leading explanations behind almost all exchange rate crises is that the real exchange rate was previously overvalued. This would explain the market speculation against the currencies and the subsequent real devaluation. Although economists do not agree on the concept of overvaluation (sometimes called misalignment or just appreciation) or on its empirical counterpart, the magnitude of two recent crises reintroduced the discussion. In 1992, the exchange rate crises in Italy, Spain, and the United Kingdom affected the perceived sustainability of the European Monetary System and cast doubts about the success of the future European Union. In 1994, the magnitude of the Mexican exchange rate crisis and its implications for global financial instability obliged the US treasury and the IMF to mobilize a rescue package.

There is a vast literature on whether exchange rate overvaluation was the main cause behind each of these crises. There has also been some effort in identifying common factors to exchange rate crises and major devaluations.[1] However, the sample of countries chosen in these studies is not adequate to answer some important questions. For example, the question *what is the probability that a currency which has appreciated by 25% in real terms will face a crisis or need a large devaluation?* cannot be answered with a sample of devaluations or crises only.[2] This sample selection bias does not exist in studies that test Purchasing Power Parity (PPP) but their focus is on whether the real exchange rate will eventually revert to its mean and not on how this reversion occurs. Surprisingly, little attention has been given to the likelihood of crises or devaluations in appreciation episodes. More generally there are, to our knowledge, no studies that focus on characterizing appreciations.

The importance of describing appreciations and the likelihood of devaluation is easier to understand as a practical matter. Several countries have used the exchange rate as an instrument to stabilize inflation and coordinate expectations around an easy focus point. In several cases, the credibility of the policymaker seems to depend largely on her ability to maintain the exchange rate peg. There are several current

[1] See Dornbusch, Goldfajn and Valdés (1995); Eichengreen, Rose, and Wyplosz (1994) and (1995); and Edwards (1989) for some recent attempts to characterize exchange rate crises and devaluations. All these studies find that the RER is overvalued during the period previous to devaluations.

[2] Klein and Marion (1994) study the duration of peg regimes in Latin America avoiding this sample selection problem. However, they do not address the questions we try to answer here. Interestingly, they conclude that the level of the RER is the main determinant of the duration of pegs.

examples. In the context of developing countries Argentina and Brazil are interesting cases. Argentina's economic policy and credibility depend largely on its ability to sustain the peg. After four years of higher inflation at home than abroad in a fixed exchange regime, the Argentinean Peso appreciated considerably in real terms. Even if one takes for granted that in the medium or long run the Argentinean Peso will revert to its PPP value, the question of how this reversion will occur is still relevant. A nominal devaluation would probably undermine the credibility of the government's economic policy and induce capital outflows *à la* Mexico. Thus, for Argentinean policymakers (and public) and international investors the question of how likely it is to have a *smooth landing* (avoiding a large devaluation), given how appreciated their currency is, becomes extremely important. The same is true in the case of Brazil.

From a theoretical perspective there are several reasons why it is important to understand the dynamics of appreciations, and especially how they are corrected. In fact, several models assume (and some derive) real costs of a nominal exchange rate devaluation. For example, in building a model to discuss whether currency crises are self-fulfilling, Krugman (1996) assumes that there are real costs in terms of reputation when the authority decides to devalue. The literature on exchange-rate based stabilizations, on the other hand, has stressed the importance of imperfect credibility as an explanation for the consumption boom and real appreciation that usually accompany such stabilizations. Credibility, in that literature, is defined as the likelihood of the abandonment of the peg.[3] Knowing whether it is possible to correct an overvaluation without a (large) nominal devaluation is a key step in evaluating the plausibility of the imperfect credibility explanation. Finally, the analysis of how likely is an appreciation episode to end through inflation differentials rather than nominal exchange rate movements sheds light to the question of how rigid nominal prices are and how persistent inflation is.

This paper empirically analyzes a broad range of real exchange rate appreciation cases. For that purpose, we define appreciations as PPP departures in the short and medium run. The cases are identified after compiling a large sample of monthly multilateral real exchange rates from 1960 to 1994. The objective is twofold. First, the paper studies the dynamics of appreciations, avoiding the sample selection of analyz-

[3]See Rebelo and Végh (1995) for an evaluation of competing explanations of the stylized facts of exchange rate-based stabilizations.

ing exclusively the crisis (or devaluation) cases. In particular, we analyze the number of appreciation cases that exist under different definitions, their duration, temporal distribution and exchange rate arrangement characteristics. The main conclusions are as follows: First, the most striking result is the large asymmetry between the duration of the appreciation build-up and the return-to-normality phases. Second, we present evidence that fixed arrangements are more likely to suffer appreciations. Third, we show that appreciation episodes happen more often during the last part of our sample period (1980–94). Finally, we also show that episodes are notably shorter when fundamentals are considered.

The second objective of the paper is to analyze the mechanism by which the overvaluations are corrected. In particular, we study what proportion of the reversions occurs through nominal devaluations rather than through nominal price adjustments (or cumulative inflation differentials). We calculate the probability of successful appreciations for various degrees of appreciation.[4] Figure 1 shows a typical result. Note that there are no successful cases when an appreciation reaches 35% or more.

The paper is organized as follows. Section 2 sets the theoretical framework that defines real exchange rates and overvaluation episodes. Section 3 characterizes appreciation episodes across time and exchange rate regimes. Section 4 decomposes the return-to-equilibrium real depreciation into the fraction of the adjustment that takes place through nominal exchange rates and inflation differentials, respectively. This section also calculates the probability of successful adjustment. Section 5 concentrates on the dynamics of appreciation episodes and calculates transition matrices. Finally, section 6 concludes.

2 Methodology and Data

In order to analyze and interpret movements of the real exchange rate (RER) as an appreciation episode one needs to define an equilibrium concept and the dynamics out of steady state. This is not an easy task. In fact, we speculate that one of the main reasons that prevented previous attempts to characterize overvaluations is the lack of a consensus around a sound empirical counterpart to any definition of the

[4] We formally define the term successful appreciation in section 4. For now, we mean appreciations that end without large nominal devaluations.

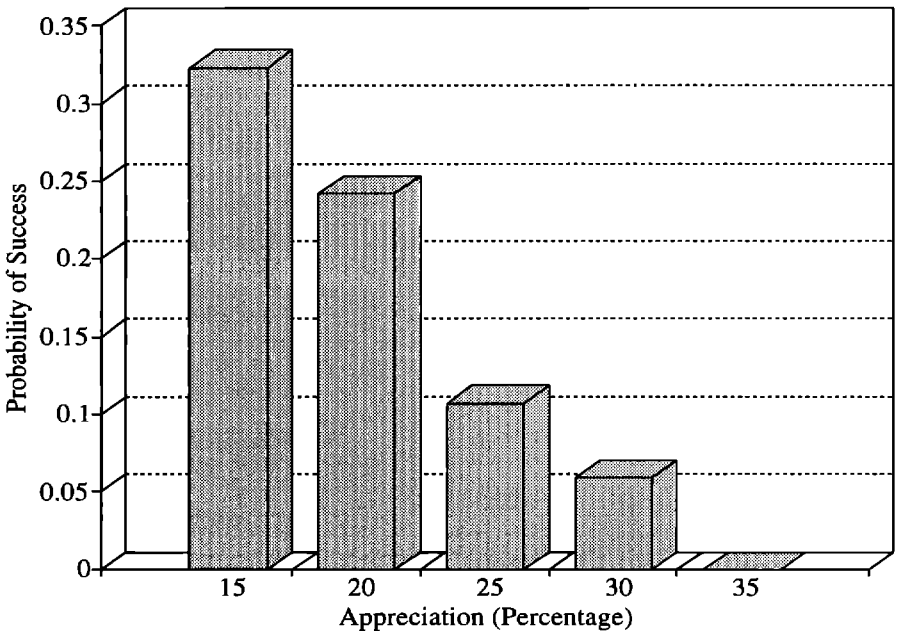

Figure 1: Probability of Successful Appreciation

equilibrium RER. The RER between two countries is defined as the relative cost of a common basket of goods measured in terms of a common numeraire: P_1/P_2, where P_i is the price of the basket in country i.

The equilibrium concept we use is *Purchasing Power Parity - PPP*, probably the simplest and most powerful theory of real exchange determination.[5] It is based on the *Law of One Price* which states that, abstracting from tariffs and transportation costs, free trade in goods should ensure identical prices of these goods across countries. This implies that the same basket of goods in two different countries must have the same price, or $P_1/P_2 = 1$.

This paper denotes by **overvaluation** or **appreciation** the episodes of PPP departures in the short or medium run.[6] The correction of PPP deviations (or overvalued RER) can be thought to occur through the following channel. An overvalued currency generates unsustainable current account deficits through the loss of com-

[5]See Dornbusch (1987) for an historical perspective.

[6]We ignore undervalued episodes. The emphasis on overvaluations in the literature and policy discussions is probably because prices and wages are flexible upwards. Presumably, undervaluations are less costly to reverse.

petitiveness. The latter also leads to possible recession and losses of reserves. All of these effects will work to adjust domestic prices expressed in foreign currency to international levels.[7]

In the definition of RER we can theoretically disaggregate the price levels in three categories: Price of exports (P_x), price of imports (P_m) and price of nontraded goods (P_n).[8] The RER is then defined as follows:

$$E \equiv \frac{P_m^{\alpha} P_x^{\beta} P_n^{\gamma}}{P_m^{*\alpha'} P_x^{*\beta'} P_n^{*\gamma'}}. \tag{1}$$

Taking logs and rearranging we have:

$$e = \{\alpha(p_m - p_m^*) + \beta(p_x - p_x^*)\} + \{\gamma(p_n - p_n^*)\} + \{(\alpha - \alpha')p_m^* + (\beta - \beta')p_x^* + (\gamma - \gamma')p_n^*\},$$

or equivalently,

$e =$ Departures from Law of One Price + Relative price of nontradables+ Terms of Trade effect.

The idea is that when the law of one price holds, ceteris paribus, there will be no pressure on relative prices (current account deficits will be optimal, wages and prices in equilibrium). This amounts to:

$$P_x = P_x^* \quad \text{and} \quad P_m = P_m^*.$$

We can abstract from the *direct* Terms of Trade effect if we assume that the weights are not so different between the baskets. If $\alpha - \alpha' = 0$, $\beta - \beta' = 0$ and $\gamma - \gamma' = 0$, then we have:

$$e = \{\alpha(p_m - p_m^*) + \beta(p_x - p_x^*)\} + \{\gamma(p_n - p_n^*)\}, \tag{2}$$

where we remain with only two components, namely departures from the law of one

[7] A fundamental issue for the interpretation of our paper is whether the RER is a trend-stationary stochastic process —that is if it tends to revert towards its mean. Recent studies have shown that this is indeed the case. See Froot and Rogoff (1995), Isard (1995) and Breuer (1994).

[8] Here the subscript m (or x) represents the import (export) good in the home country which is, also, the export (import) good of the rest of the world.

price and nontradables price differences.

If we assume that differences in nontradable prices do not exert reverting pressures (as in the case of haircuts), then only differences in tradable prices should be considered in the overvaluation measure. Therefore, one needs to disentangle the two components of the RER above. One approach is to assume that equilibrium movements in the term $\gamma(p_n - p_n^*)$ of equation (2) occur slowly and that time trends will capture these movements.[9] A second approach is to control for the effects of fundamentals by regressing the RER on several variables that are related to nontradable prices but not to departures from the law of one price.[10]

We follow both approaches in the paper. We first follow the approach of regressing the RER on time trends, without taking into account fundamentals. Besides being a simple procedure, this would be the optimal approach if the price index had a small proportion of nontraded goods, and their prices change smoothly.[11] For each country we calculate

$$E^{pr} = \alpha + T'\beta, \tag{3}$$

where E^{pr} is the predicted value from the regression of the log of the RER on two time trends (linear and square) denoted by T.

Using the predicted value as our equilibrium real exchange rate, the departures from equilibrium are calculated as follows (normalizing the series to 100 when the RER is in equilibrium):

$$E^* = 100 + 100 \times \frac{E - E^{pr}}{E^{pr}}, \tag{4}$$

where E is the original series.

[9] An example of these movements is the Balassa-Samuelson effect. When there is a productivity growth differential between the traded and nontraded goods sectors *and* this differential is not homogeneous across countries, then the (cross country) relative prices of nontraded goods, and therefore, the RER, will change over time.

[10] One could argue that some of the fundamentals chosen may also be related to the departures from the law of one price. In this case, this second approach will tend to underestimate the extent of overvaluation. Since the first approach does not control for fundamentals and may overestimate the extent of overvaluation, one can interpret the resulting two series as defining the boundaries of the true overvaluation episode.

[11] Since the RER is trend-stationary this is a perfectly valid procedure.

2.1 Controlling for Fundamentals

We also follow the second approach. Here we assume that nontraded prices do change with movements in fundamentals. Thus, we want to clean RER movements from changes in the term $\gamma(p_n - p_n^*)$ of equation (2).

Operationally, we calculate for each country:

$$E^{pr} = \alpha + T'\beta + X'\gamma, \tag{5}$$

where X is the set of fundamentals.

The fundamentals we use to isolate the RER movements from movements of nontraded good prices are the following:[12]

Terms of Trade (TOT) TOT shocks affect the relative price of nontradables in small open economies.[13] If there is a positive permanent shock, the demand for nontradables will increase with the increase in permanent income. In equilibrium, the relative price of nontradables will rise and we should observe a real appreciation.

If the shock is temporary, and therefore the effect on permanent national income is small, the demand for nontradables will not increase and the relative price of nontradables will not react, provided the supply is unchanged. This will be the case whenever there is a fixed cost to move resources out of the tradable sector and decrease the supply in the short run. Otherwise, even temporary TOT shocks can have an effect on the RER. Here we assume that TOT affect the equilibrium RER through supply effects only in the long and medium run. Then, the optimal procedure is to net out the effect of TOT and smooth the resultant predicted values. In this way long run trends will be captured and very short effects smoothed.

In the case of large countries there is an endogeneity problem because the TOT are defined simultaneously to the relative price of nontraded goods.

Government Spending An expansion in government spending will appreciate the RER if it increases the overall demand for nontradables. This will be the case if the

[12] One may consider capital inflows as an additional fundamental. However, these flows are just the counterpart of the current account plus reserves, and therefore, are simultaneously determined with the RER. For that reason, we chose not to include them in the regressions.

[13] See Edwards (1989).

government propensity to consume nontradables is larger than the private sector's. When the propensities are the same and an increase in expenditures is financed by debt the effect depends on how permanent is the shock and how forward looking are consumers. As a general rule, the effect on nontradable prices increases the more temporary the government shocks are (when the shocks are temporary the private sector will not decrease consumption proportionally) and the less forward looking consumers are (Ricardian equivalence will not hold). We measure government spending as the ratio of government expenditures to GDP.

Openness Openness reflects how connected the economy is to the rest of the world and stands here for trade liberalization. It is proxied here by the ratio of exports plus imports to GDP.

A trade liberalization generates an equilibrium RER depreciation from a labor market general equilibrium perspective. The decrease in tariffs generates the necessity of a crowding-in to restore full emplyment. This, in turn, requires a reduction in the price of nontradables.[14]

Some transitory shocks to the fundamentals we consider have no effect on equilibrium RER's.[15] In this case, because the regression in equation (3) will capture the long run relationship between the RER and fundamentals, short run movements in the latter may generate *false* short term movements in our "equilibrium" estimate. These movements, however, will be unrelated to movements in the actual RER. In order to minimize this effect, we smooth the predicted RER's with a 12-month centered moving average.

2.2 Episode Definition and Phases

Figure 2 presents an example of an appreciation episode. We define the start of an appreciation case as the time when the difference between the actual RER and our estimate of "equilibrium" RER (the predicted value from equations (3) or (5)) is equal or higher than a certain threshold (e.g., 15% or 25%). The appreciation ends when this difference hits a second threshold associated with the existence of no

[14] See Dornbusch (1974).

[15] An example is given by a transitory positive shock to the terms of trade.

appreciation. We define this second threshold as 5%. In order to control for data blips, an episode has to be sustained for more than 2 consecutive months to classify as such.

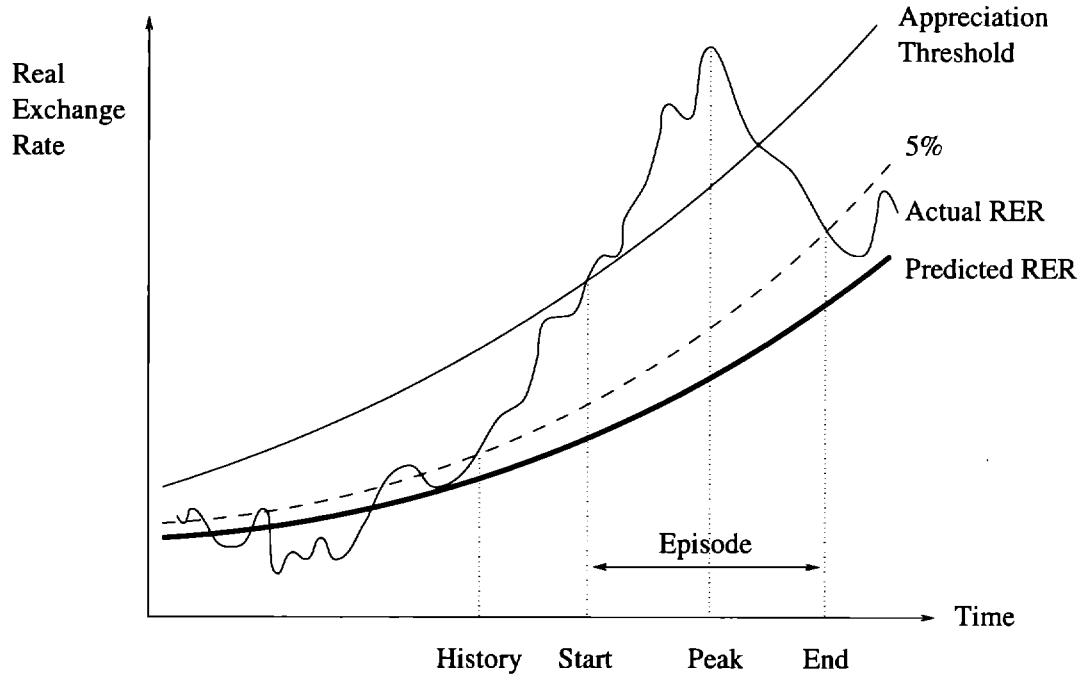

Figure 2: Appreciation Episode Definition and Phases

We define four notable points: (i) *Start*, when the appreciation hits the threshold, (ii) *End*, when the appreciation disappears —i.e., the RER hits the 5% benchmark, (iii) *Peak*, when the appreciation is the highest, and (iv) *History*, when the appreciation first reached 5%. An appreciation episode is then defined as the Start-End period.

There are also two phases: History-Peak, representing the build-up problem and Peak-End, representing the return to a "normal" level.[16]

[16]The phases add-up to more than an episode because the latter does not include the build-up to the appreciation threshold. In characterizing episodes, we are interested in what happens conditionally on being appreciated, not just in general.

2.3 Data Description

The initial sample is given by monthly data of 93 countries during the period 1960–1994 (39,060 observations). Because of missing values the actual sample size of RER is equivalent to 86.1% of the potential sample (when we include fundamentals the actual sample size falls to 73.6% of the potential sample size). The initial sample is composed of countries in the Summers and Heston database with more than 1 million people in 1985, with monthly price data from the International Financial Statistics (IFS), and with origin-destination trade data from the United Nations' *Yearbook of Trade Statistics.* The list of countries is presented in appendix D.

We construct the multilateral RER for each country as a trade-weighted average of bilateral RER's with those trading partners encompassing 4% or more of trade (in either exports or imports). The weights are fixed and represent the trade flows of 1985, or the closest year for which data is available. They are presented in appendix E.[17]

In order to minimize the effect of movements in nontradables prices, we construct our empirical measure of RER using WPI when possible. Consumer price indices may contain a large proportion of nontraded final goods in their index that have little effect on competitiveness. It is not surprising, then, that it is easier to reject the random walk hypothesis when WPI are used in PPP tests. When countries do not have a reliable WPI series we use CPI. This is the case with some developing countries (see appendix D for a complete list). Since these countries tend to have also a higher inflation than the average, we are confident that even these cases have a mean-reversion process.

One caveat regarding our RER construction is that some WPI's may have a large component of an imported intermediate good that is not produced at home. This implies that for some countries the WPI may not be a good proxy for their price level and competitiveness. Although we do not control for these cases and, therefore, we may not detect some appreciation cases, this should not bias our results regarding how the RER returns to equilibrium.

[17] We checked for data errors in the original data using graphic methods. The price series of El Salvador for 1977 was geometrically interpolated from December 1976 and January 1978 because it shows a break in 1978 (the IFS flags the series as having a break and it shows deflation of 21% in 1 month). Missing values of price data of Ghana (Apr.'81–Jan.'82), Iran (Jul.'86–Mar.'89), and Kuwait (Jan.'84–Dec.'84) were also interpolated.

In order to analyze the role of the nominal exchange rate and inflation differentials in the return-to-normal phase of the RER one needs a nominal exchange rate index for each month and country. We construct this index using the exchange arrangement description of the IMF annual report *Exchange Arrangements and Exchange Restrictions*. The report presents for each country a summary of the exchange arrangement status as of December of each year and a chronology of changes during that same year. We use this information to construct a monthly exchange arrangements database describing the principal features of the arrangements. Appendix C presents a description of the coding and summary statistics describing the arrangements. With this data on hand we construct a nominal index for each month and country. When the arrangement is a peg we use the respective nominal exchange rate; when the arrangement is an unknown basket we usually use the nominal exchange rate with respect to SDR (in some cases we use the last peg); when the arrangement is floating we use the currency used in the last peg that was in place.[18]

The data for the construction of fundamentals has annual frequency and the sources are the following: Terms of Trade are from the World Bank Tables completed with unit import and export prices from the IFS for 1960–64 and 1993–94. Openness (the ratio of exports plus imports to GDP) and government spending (as percentage of GDP) are from the Summers and Heston database, completed with the World Bank's *Development Report* data for 1993–94 when possible.[19]

3 Characterizing Appreciations

This section presents several features of the episodes in our sample. In particular, we analyze the number of appreciation cases that exist under different definitions, their duration, temporal distribution and exchange rate characteristics. The main conclusions can be summarized as follows: First, the most striking result is the large asymmetry between the duration of the appreciation build-up and the return-to-normality phases. Second, we present evidence that fixed arrangements are more

[18]We classify target zones with a width less than 7% as pegs. We classify crawling pegs, managed floating, and periodic adjustable pegs as flexible arrangements and use the underlying nominal exchange rate for our index.

[19]In order to use these data in monthly regressions we interpolate the yearly data using June as the base month.

likely to suffer appreciations. Third, we show that appreciation episodes happen more often during the last part of our sample period (1980-94). Finally, we also show that episodes are notably shorter when fundamentals are considered.

3.1 Number of Appreciations

The number of appreciations episodes that exist in our sample depends on both the cutoff that defines appreciations (the threshold that defines the start date in figure 2) and the method we use in defining the "equilibrium" RER (the RER^{pr} in equations (3) or (5)). Table 1 presents these results.

Table 1: Number of Appreciation Episodes

Apprec. Cutoff	RER Estimate	
(percentage)	Trends Only	Fundamentals
15	173	158
20	111	91
25	71	56
30	52	34
35	36	20

As expected, the number of episodes declines with the appreciation cutoff (for example, there are only 36 and 20 cases that had an appreciation larger than 35%). Also, there are less cases when we take into consideration the effect of fundamentals in the equilibrium RER estimation. The methodology disregards some appreciations episodes that were previously detected because their actual RER movements are now considered equilibrium changes (given the movement of fundamentals).[20]

[20]We also get some new episodes because of movements in fundamentals. We smoothed the predicted RER in order to minimize the number of "false" appreciation cases —the ones driven by excess movement of our equilibrium values. See section 2.1.

3.2 Duration

The average duration of appreciations depends on both the threshold that defines appreciations and whether fundamentals are considered. Moreover, duration is very different between the History-Peak and Peak-End phases. In what follows we will focus on 4 benchmark cases: appreciation thresholds of 15% and 25%, with and without controlling for fundamentals. Table 2 presents the statistics of average duration in months, including incomplete cases.

Table 2: Average Duration of Appreciations (Months)

	Entire Episode	History-Peak	Peak-End
Trends – 15%	22.2	19.5	11.1
Trends – 25%	22.8	26.8	11.1
Fundam. – 15%	11.2	10.2	6.8
Fundam. – 25%	8.5	12.3	4.6

The average duration of appreciations using only time trends to estimate the equilibrium is about 2 years. Using fundamentals, the average duration drops by approximately 1 year. This pattern of shorter duration when one takes into account fundamentals also holds in the History-Peak and Peak-End phases. Interestingly, the average duration of the Peak-End phase is approximately one half of the duration of the History-End period. Of course, behind this difference is the sudden return to equilibrium produced by nominal devaluations.

We also present the frequency histograms of duration of our benchmark cases. Figures 3 and 4 present the cases of entire episodes given an appreciation threshold of 15%, with and without considering fundamentals. Figures 5 and 6, on the other hand, present the histogram of the History-Peak and Peak-End phases duration with the same threshold. Figures 19 to 22 in appendix A present the cases for an appreciation threshold of 25%. The same conclusions hold. Duration is highly asymmetric between the build-up and the come-back phases. The higher duration of the History-Peak phase spreads over all categories of duration lasting more than 4 months. This last conclusion is independent of the threshold and whether fundamentals are con-

sidered. Also, including fundamentals reduces the duration of the episodes (not only the average duration).

A final question regarding duration is what happens with incomplete cases, that is, cases that remained being an episode when the data of the respective country ended. If these cases had significantly longer durations than the complete episodes, there would be evidence that they are of a different nature, namely equilibrium appreciations (not picked-up by trends and fundamentals) that only in the long run would disappear. Table 3 shows the average duration (and number of episodes) of such cases. The main conclusion is that these durations are almost always *smaller* than the durations of complete cases.

Table 3: Average Duration of Incomplete Appreciations

	Episodes (number)	History-Peak	Peak-Incomplete
Trends – 15%	15.1 (16)	16.6	7.8
Trends – 25%	11.4 (5)	20.4	6.8
Fundam. – 15%	7.4 (8)	11.6	2.3
Fundam. – 25%	9.0 (3)	17.7	1.7

3.3 Temporal Distribution

Several structural changes in the world economy may have affected the temporal distribution of appreciation episodes. Among other factors, changes in inflation levels, capital mobility, and exchange arrangements may have produced bunching of cases during some periods.[21] The presumption is that the first two have raised the likelihood of appreciations during the second part of our sample, while the movement towards more flexible exchange regimes may have decreased it.

Because our panel data is unbalanced —some countries have more observations than others— the simple time path of number of cases is a misleading indicator of the temporal distribution of cases. Instead, we present the ratio of episodes to total

[21] See appendix C for a description of exchange arrangements during our sample period.

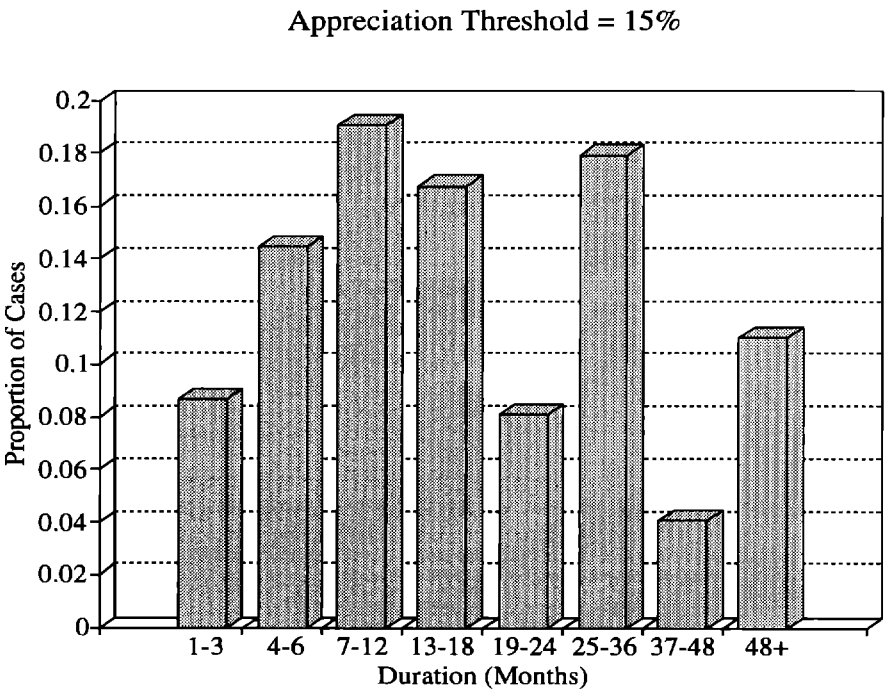

Figure 3: Histogram of Duration - Trends Only

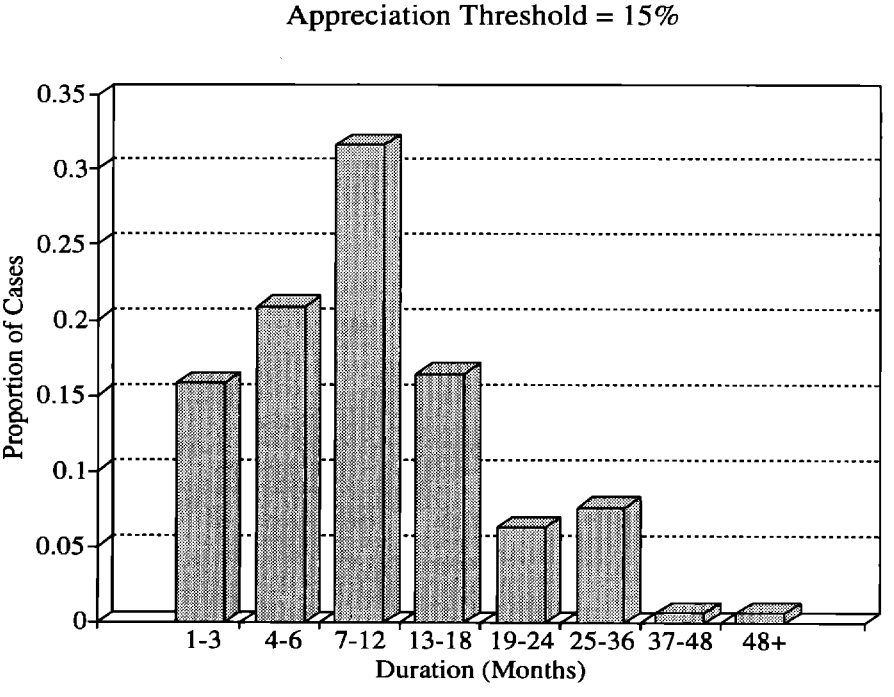

Figure 4: Histogram of Duration - Fundamentals

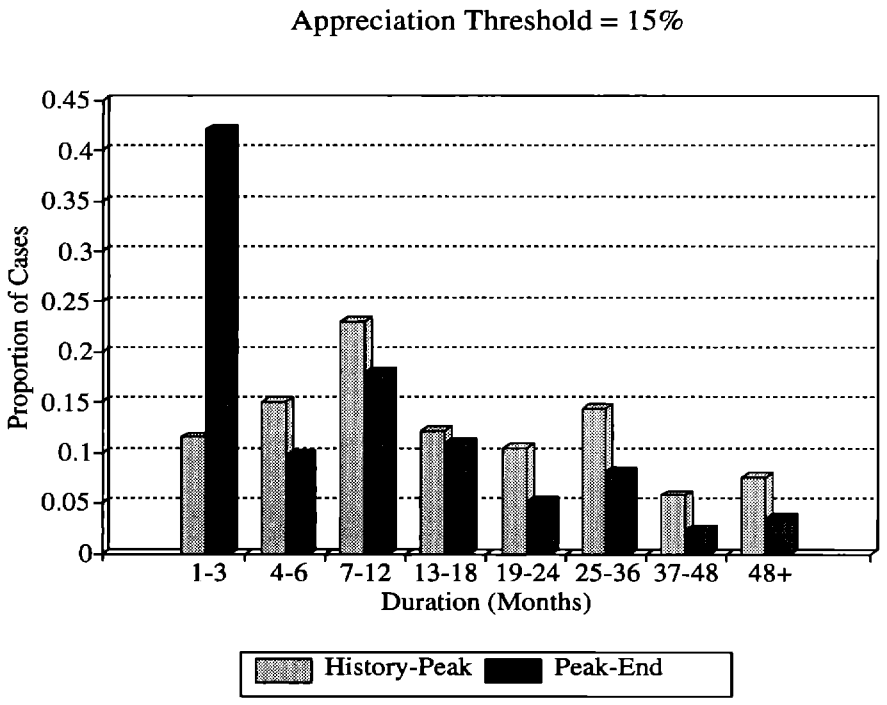

Figure 5: Phases Duration - Trends Only

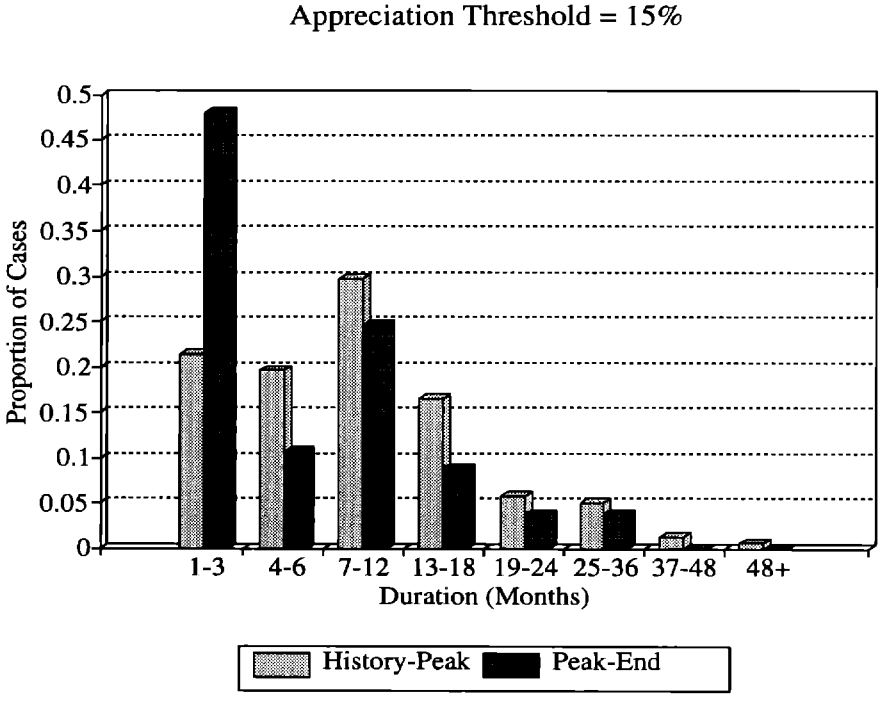

Figure 6: Phases Duration - Fundamentals

countries in the sample with data grouped every 5 years. Cases are dated using the date of Start.[22] The results for the benchmark cases with an appreciation threshold of 15% is presented in figures 7 and 8. The cases with a threshold of 25% are presented in figures 23 and 24 in appendix A.

The graphs show that towards the second part of our sample the number of cases clearly increases. In fact, during the period 1980–94 there are at least twice as much cases as during 1960–75 (controlling for the number of potential episodes). The cases with RER's after controlling for fundamentals show an even more clear upward trend. Interestingly, when only trends are considered, there is a notorious bunching of episodes around 1980–85.

3.4 Exchange Arrangements

The overall trend of exchange arrangements is towards more flexible systems, although some countries have changed their systems back to fixed regimes. Appendix C describes our characterization of exchange arrangements and presents summary statistics for our sample period.[23]

In order to evaluate whether appreciation episodes happen more often under specific exchange rate arrangements we compare the proportion of each type of arrangement during the episodes (more specifically during the History-Peak and Peak-end phases) with the proportion of each type observed in the total population.[24] Because of the trends issues discussed above, a total average would be misleading for the number of appreciations has increased over time and fixed exchange rate arrangements have declined. In order to control for this problem we compare the proportion of each type of arrangement of episodes grouped every 5 years with the population proportion during those same 5 years. We then calculate a weighted average of this indicator using the actual number of episodes that occurred during those same 5 years. The date of the episodes is assigned according to the Start date. Table 4 presents these

[22]Notice that this ratio is not immune to composition effects. An example is given by developed countries having more data, and being less likely to suffer appreciations.

[23]Using a panel of annual data, Ghosh et al. (1995) study the impact of exchange arrangements on inflation and growth. They conclude that fixed regimes have less inflation and that the arrangement is unrelated to growth.

[24]In cases in which episodes have more than one arrangement we calculate the episode's proportion of each arrangement according to the number of months each arrangement was in place.

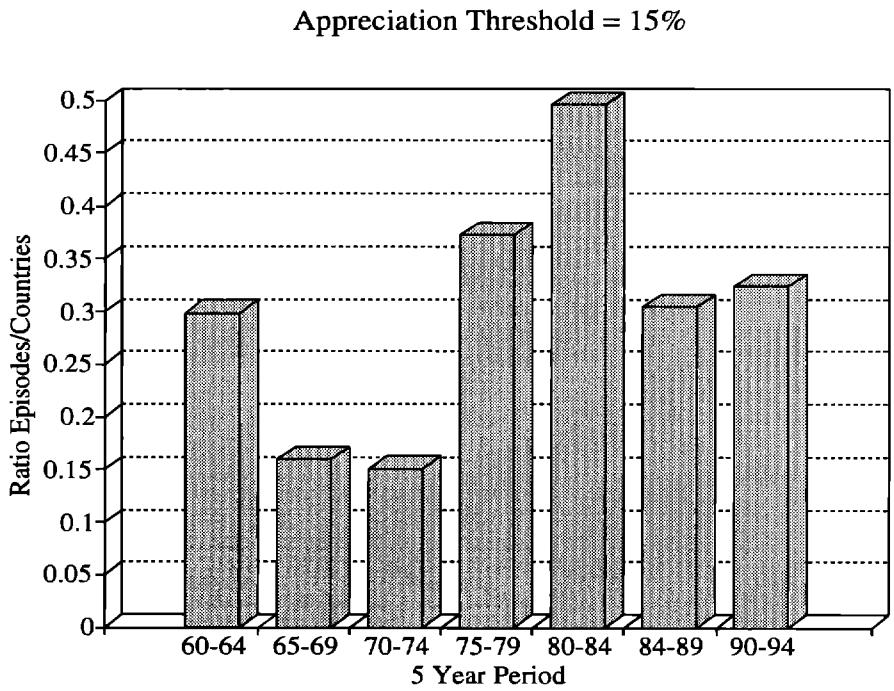

Figure 7: Temporal Distribution - Trends Only

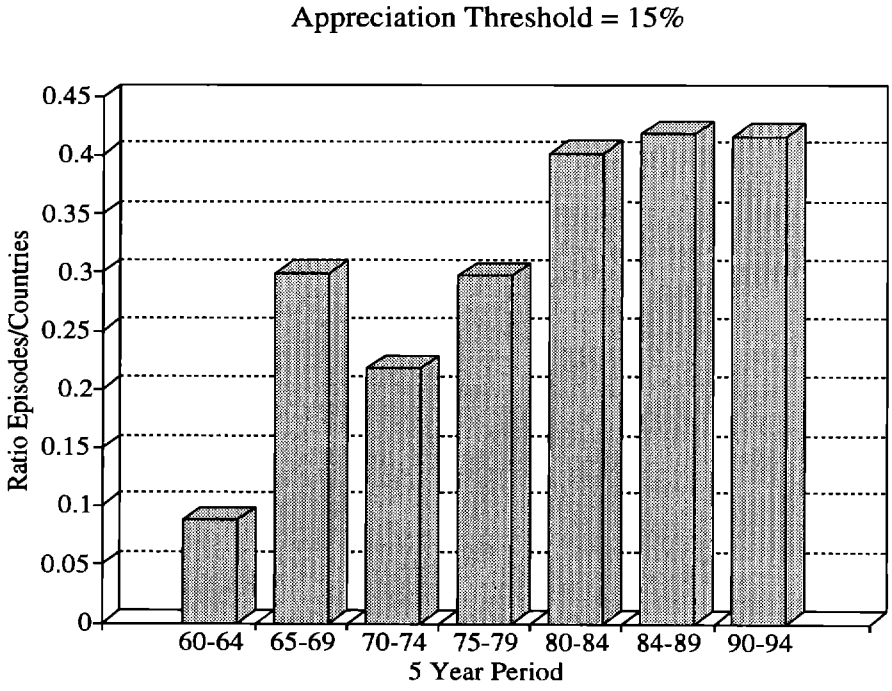

Figure 8: Temporal Distribution - Fundamentals

results.

Table 4: Exchange Arrangements of Appreciations
Proportion of Each Arrangement

		Trends 15%	Trends 25%	Fundam. 15%	Fundam. 25%
History-Peak	Fixed	68.9	79.3	74.1	74.4
Phase	Flexible	24.5	17.9	21.6	22.1
	Floating	6.6	2.8	4.4	3.4
	Dual-Mult.	32.3	40.1	37.0	54.8
Peak-End	Fixed	63.1	71.9	68.6	65.7
Phase	Flexible	29.2	24.4	25.0	26.9
	Floating	7.7	3.6	6.3	7.4
	Dual-Mult.	35.8	48.2	36.2	50.9
Total	Fixed	62.0	60.8	61.5	59.7
Population	Flexible	31.3	32.4	31.9	33.3
	Floating	6.7	6.8	6.7	7.0
	Dual-Mult	16.9	17.1	17.5	17.5

Average calculated every 5 years and weighted by the number of episodes every 5 years.
Number represents percentage of time of each arrangement.

The results show that, as expected, fixed regimes are more likely to suffer appreciations. This effect is higher when larger appreciations are considered. Flexible regimes are less likely to suffer appreciations. These regimes include crawling pegs, adjustable bands, adjustable pegs to baskets, and managed floating. In terms of dual and multiple exchange rates, the results show that during appreciations episodes, countries have these arrangements at least twice as many as in normal times. This could be interpreted as implying that dual-multiple regimes have a higher probability of appreciating. However, in this case the reverse causality also exists. When an episode starts countries are more likely to put in place dual markets in order to

improve the competitiveness of certain sectors.[25]

There are clear asymmetries in the exchange arrangements prevailing during the History-Peak and Peak-End phases. In particular, the proportion of fixed exchange rate arrangements is notably larger during the History-Peak period. The contrary happens with flexible and floating arrangements. This fact gives support to the notion that the return-to-equilibrium is more easily accomplished by flexible exchange regimes. These results hold independently of appreciation thresholds and whether fundamentals are included. Dual systems do not appear more likely during either phase.

4 Nominal Exchange Rate-Inflation Decomposition

One of the basic questions in this paper is whether there are appreciation episodes that do not end in exchange rate collapses or large devaluations. More specifically, one can ask how do appreciation episodes end: Is the inflation differential —prompted by the loss of competitiveness— enough to return to the equilibrium RER? How much of the total work is done by the nominal exchange rate? In order to answer these questions we constructed a monthly nominal exchange rate index for each country. This index follows the movements of the pegs that a country may have, including changes in the currency to which the peg is established. In cases in which unknown baskets of currencies are the nominal target we use the nominal exchange rate with respect the SDR. In cases of flexible and floating regimes we use the price of the currency last used as a peg.

In order to decompose the real depreciation that occurs during the return to the equilibrium we calculate the total depreciation of the actual RER during the Peak-End phase, and the total nominal actual depreciation during that same period. *Successful* appreciations can then be defined as episodes that require less than a certain threshold in order to return to the equilibrium.[26] Letting Δ denote percentage change we have

[25]This effect also means that, in these cases, the nominal exchange rate used to calculate the real exchange rate loses its relevance.

[26]There is an important issue regarding appreciation cases that happen after a "structural" break in the equilibrium RER. Our methodology does not allow for such changes, so we count this break

the identity:

$$\Delta E = \Delta \text{Nom} + \Delta \left(P - P^* \right)$$

where Nom is the nominal exchange rate index and P and P^* the price indices. We can then calculate

$$S = 1 - \frac{\Delta \text{Nom}}{\Delta \text{E}}$$

as our successful index.

4.1 Detrended RER

4.1.1 Successful Index Distribution

A first issue to analyze is the distribution of our successful indicator S. Knowing this distribution will allow us to measure how sensitive the definition of successful is to the threshold for S. In particular, if very few cases are partially successful, the threshold one chooses is not crucial.

Figures 9 and 10 present the histograms of the S indicator for our two benchmark cases using the first methodology (trends as the equilibrium concept). We observe a large mass of cases that are not successful at all —the nominal devaluation does more than all the work.[27] There is also some mass in totally successful cases —the inflation differential does all the work. There are few cases in which the appreciation was partially successful.

Finally, comparing figures 9 and 10, we observe that when larger appreciations are considered, there is less probability of success (for any S). There is less mass on or close to $S = 1$ in figure 10, where the threshold is 25%.

4.1.2 Searching For a Critical Cutoff

Knowing the distribution of S we can now search for the critical level of appreciation: the level at which a successful episode is very unlikely to happen. We define (arbitrarily) a successful appreciation when the nominal exchange rate does less than

as an episode (that has an end). The key is that if this is the case, then the RER during the whole episode is not under any pressure and nominal devaluations should not occur. This biases our results towards observing successful cases.

[27] Inflation differentials may have a negative contribution to the return. In this cases, nominal devaluations do *more* than all the work.

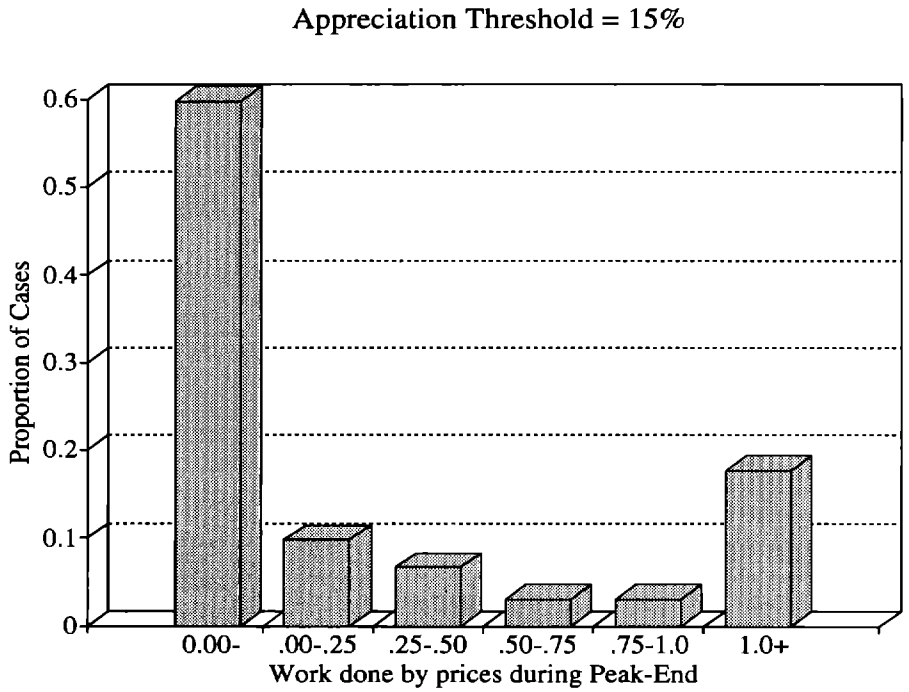

Figure 9: Histogram of Success - Trends Only (15%)

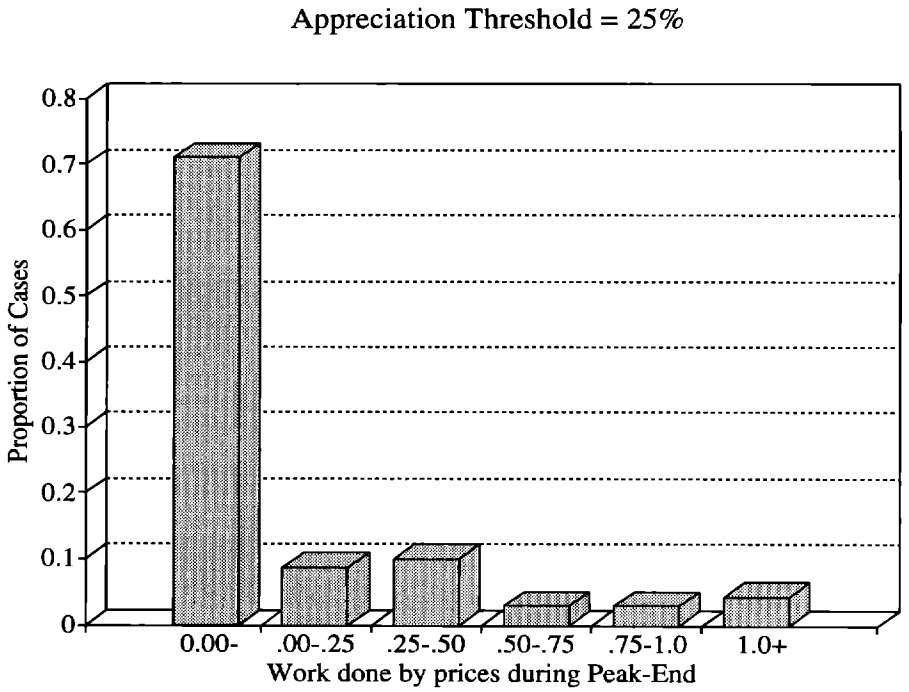

Figure 10: Histogram of Success - Trends Only (25%)

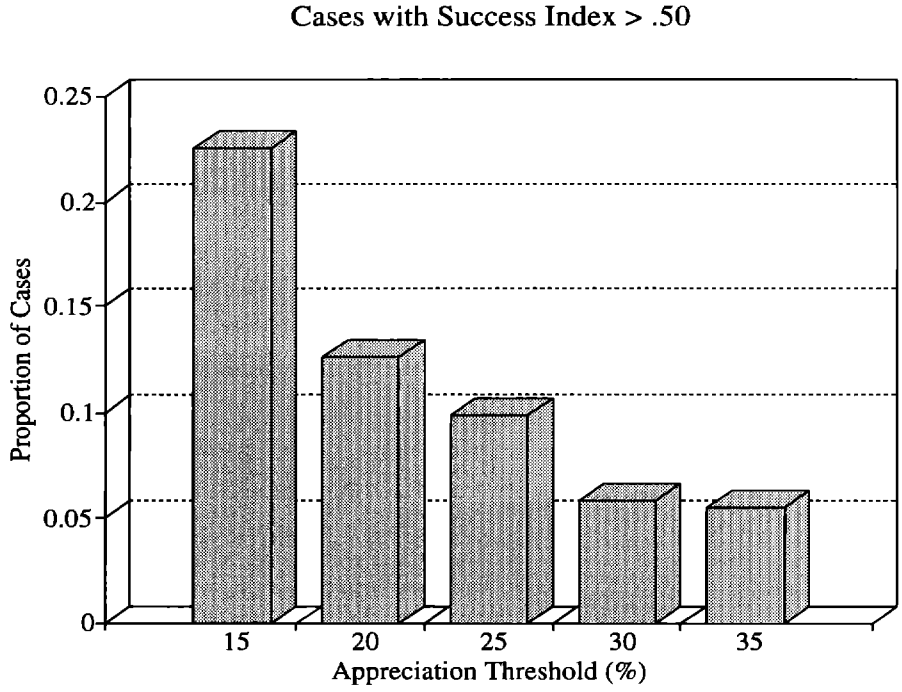

Figure 11: Probability of Successful Appreciation - Trends Only

half of the work ($S > 0.5$). Since the mass of partially successful cases is small our conclusions do not critically depend on the successful definition. Figure 11 shows the probability of success for different appreciation levels. Here each episode is considered as one case, regardless of its duration. (In section 5 we explore in more detail the link between degree of appreciation, time, and the probability of success).

When appreciations of 25% or more are considered only 10% of the cases are successful —that is they devalue less than 50% of the observed real depreciation between Peak and End. This probability clearly decreases with the appreciation level. The conclusion is that for large appreciations, say 25% or more, it is unlikely to undo an appreciation without a devaluation; sooner or later a nominal exchange rate correction is required.

4.1.3 Successful Episodes: Description

This subsection describes the appreciation episodes in which the nominal devaluation caused less than half of the total real depreciation, so they can be considered as relatively successful cases. The initial sample includes appreciations of 25% or more,

with respect to the trend RER.

Table 5: Successful Appreciation Episodes

Country	Start-Date	Duration (months)	Actual Build-up	Actual Deprec.	Fixed X-Arr	Estimated Build-up
Paraguay	Oct.'77	5	22.6	32.3	1.0	25.1
Nepal	Oct.'72	2	22.1	36.5	1.0	27.0
Sri Lanka	Aug.'70	86	–9.7	196.0	0.7	37.3
Sri Lanka	Feb.'94	9	14.0	5.4	0.0	25.1
Burundi	Feb.'85	16	23.4	40.9	1.0	27.5
Ethiopia	Aug.'84	22	35.0	55.1	1.0	37.7
Nigeria	Jan.'60	45	–	–4.1	1.0	34.1

Success if $S > 0.50$ – Appreciation Threshold = 25%

The list shows that these countries are not typical appreciation cases; if one considers medium and large size countries the probability of success is even smaller. Notably, almost all have fixed exchange arrangements. This does not mean that fixed arrangements should be kept in place, for the probability of success of these arrangements is small. The key policy recommendation is to avoid the appreciation in the first place (or at least weight its benefits with the high probability of future devaluation).

Finally, notice that a couple of successful episodes do not suffer an actual real appreciation during the build-up period or an actual real depreciation during the return-to-normality phase. Trends in the RER make these cases to be identified as appreciations under our definition.

4.2 RER and Fundamentals

If one repeats the exercise of the last section using the predicted RER calculated with fundamentals none of the conclusions change. Moreover, the conclusion regarding how difficult it is to undo appreciations without nominal devaluations is stronger: there are no experiences of successful episodes if appreciations of 35% or more are considered.

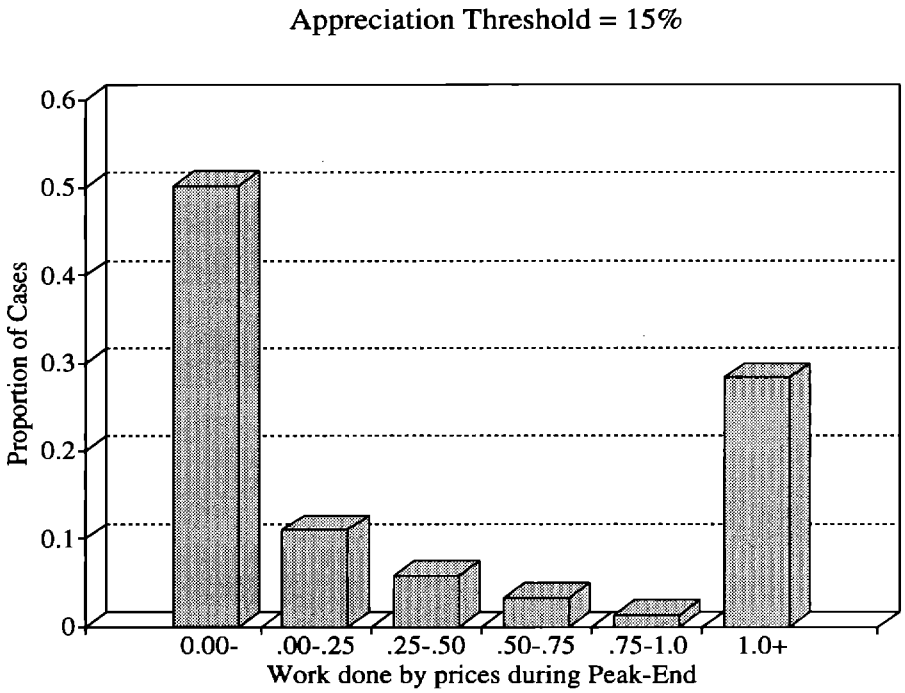

Figure 12: Histogram of Success - Fundamentals (15%)

Figures 12 to 13 show these results.

4.3 Conditional Probabilities

This subsection reports probabilities of successful appreciations conditional on different characteristics. Table 6 presents the results. First, during the second period of the sample, 1980–1994, the probability of successful appreciations is substantially lower than in the first period. Second, there is no apparent pattern relating successful appreciations with the duration of the episodes. Third, as expected, flexible and floating regimes are less prone to return to equilibrium through price changes.

5 Degree of Overvaluation and Transition Matrices

One of the objectives of this study is to identify the probability of RER reversion in a certain period of time, for various levels of appreciation. In particular, we would

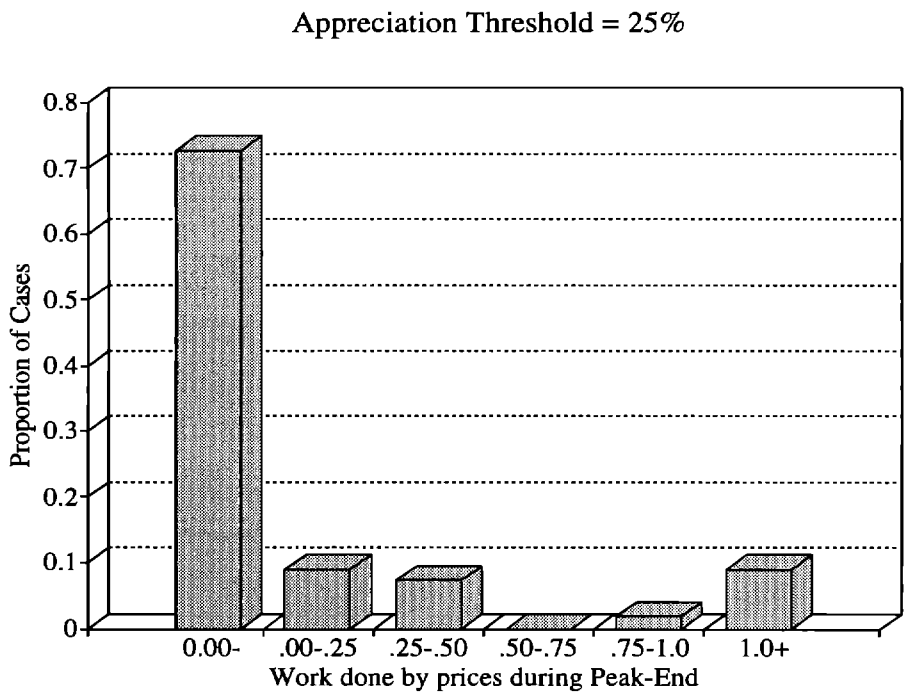

Figure 13: Histogram of Success - Fundamentals (25%)

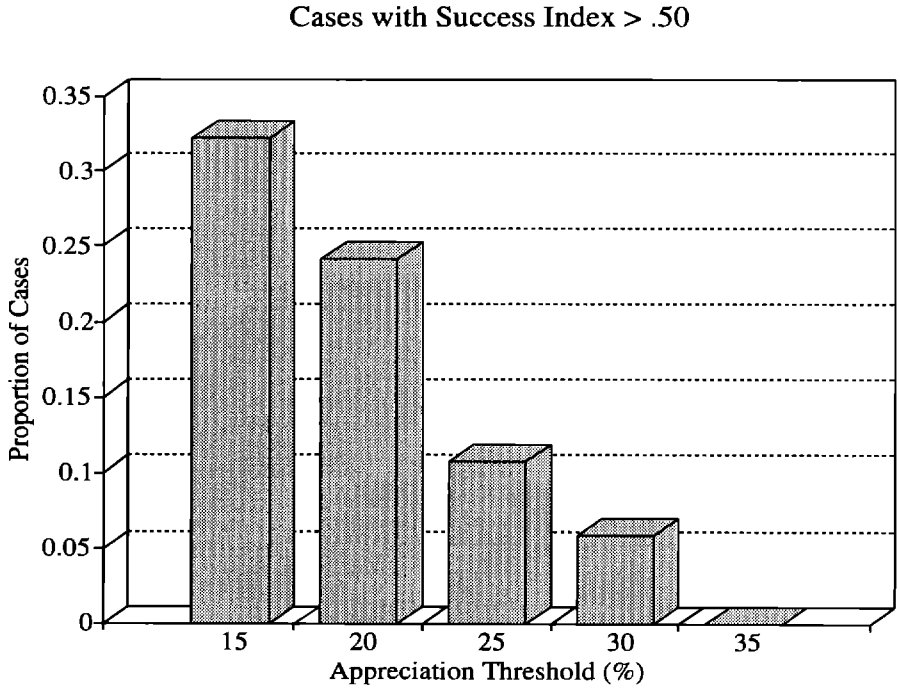

Figure 14: Probability of Successful Appreciation - Fundamentals

Table 6: Probability of Success - Different Sampling
(Percentage)

Trends Only				
Apprec. Threshold	Total Sample	Float and Flexible	Start after 1980	Long Duration
15	22.5	8.3	14.9	21.5
20	12.6	6.3	10.5	15.7
25	9.9	5.6	6.1	9.6
30	5.8	0.0	2.6	7.9
35	5.6	0.0	3.6	6.9
Fundamentals				
Apprec. Threshold	Total Sample	Float and Flexible	Start after 1980	Long Duration
15	32.3	2.2	16.8	38.0
20	24.2	3.8	13.6	33.3
25	10.7	0.0	5.3	16.0
30	2.9	0.0	3.8	5.6
35	0.0	0.0	0.0	0.0

Long duration = $End - Start > 6$ months.

like to test the assertion that the probability of returning to equilibrium is positively correlated to the degree of appreciation.

We constructed *transition matrices* for our appreciation cases. The matrices show the probability of reaching a specific exchange rate value conditional on a given degree of appreciation. The overall sample is the exchange rate values of the appreciation episodes, defined using the benchmark cutoff of 15%. Therefore, the matrices show the conditional probability of reaching a specific exchange rate value *once a country has surpassed 15% appreciation in the past.*

Table 5 presents the results for the case of trend RER. There are two points to highlight from the table. First, there is a high degree of inertia in RER's. All the diagonal terms (shadowed for contrast) show substantially higher probabilities.[28] In part, this is a consequence of the relatively short transition time shown: 6 and 12 months. In fact, the transition table for 24 months (shown in appendix A) shows lower inertia, although we still observe higher probabilities along the diagonal.

Second, once high degrees of appreciation are achieved (for instance, 30% in table 5), there is a low probability of moving to a slightly lower appreciation degree (in this case 0.05 to reach 20–25%), but a high probability of reversing the whole appreciation (0.24 to reach a value lower than 5%). This result shows that smooth returns are highly improbable in large appreciation cases and get more unlikely as the appreciation deepens.

Figure 15 plots the probability of returning to an appreciation of less than 5% for several levels of appreciation. It plots the last column of the transition matrices described above (for 6 and 12 months), but also other transition times as 1, 3, 24 and 48 months. As expected, the longer the period considered, the higher the probability of return. With 48 months, for example, the probability of return ranges from 80 to 96%. This confirms the latest PPP mean-reversion results in the literature.

The more interesting and relevant result is the U-shaped curve obtained for the probability figures. It shows that there is a threshold where increasing the level of appreciation implies a higher probability of return. The reason for the nonlinearity is the existence of a trade-off between *distance* and *pressure* factors. Since each curve in figure 15 is plotted fixing the time period available to return, it is reasonable to

[28]There is a substantial larger mass in the diagonal term of appreciations of equal or higher than 30%. However, there is also more support in this area.

Table 7: Transition Matrices of Appreciations - 6 and 12 Months

Detrended RER
Appreciation Threshold = 15%

6 Months Matrix

RER Appreciation in t+6 months

	30+	30-25	25-20	20-15	15-10	10-5	5-
30+	0.58	0.07	0.05	0.02	0.02	0.01	0.24
30-25	0.23	0.29	0.18	0.07	0.02	0.01	0.19
25-20	0.08	0.22	0.26	0.12	0.08	0.03	0.20
20-15	0.02	0.03	0.20	0.25	0.20	0.10	0.18
15-10	0.00	0.01	0.04	0.17	0.27	0.24	0.26
10-5	0.00	0.01	0.01	0.06	0.16	0.26	0.50

12 Months Matrix

RER Appreciation in t+12 months

	30+	30-25	25-20	20-15	15-10	10-5	5-
30+	0.39	0.06	0.04	0.03	0.03	0.01	0.44
30-25	0.22	0.15	0.11	0.08	0.05	0.02	0.36
25-20	0.10	0.16	0.19	0.10	0.07	0.05	0.34
20-15	0.04	0.07	0.14	0.12	0.16	0.12	0.36
15-10	0.01	0.01	0.04	0.13	0.18	0.18	0.44
10-5	0.01	0.00	0.03	0.03	0.09	0.10	0.74

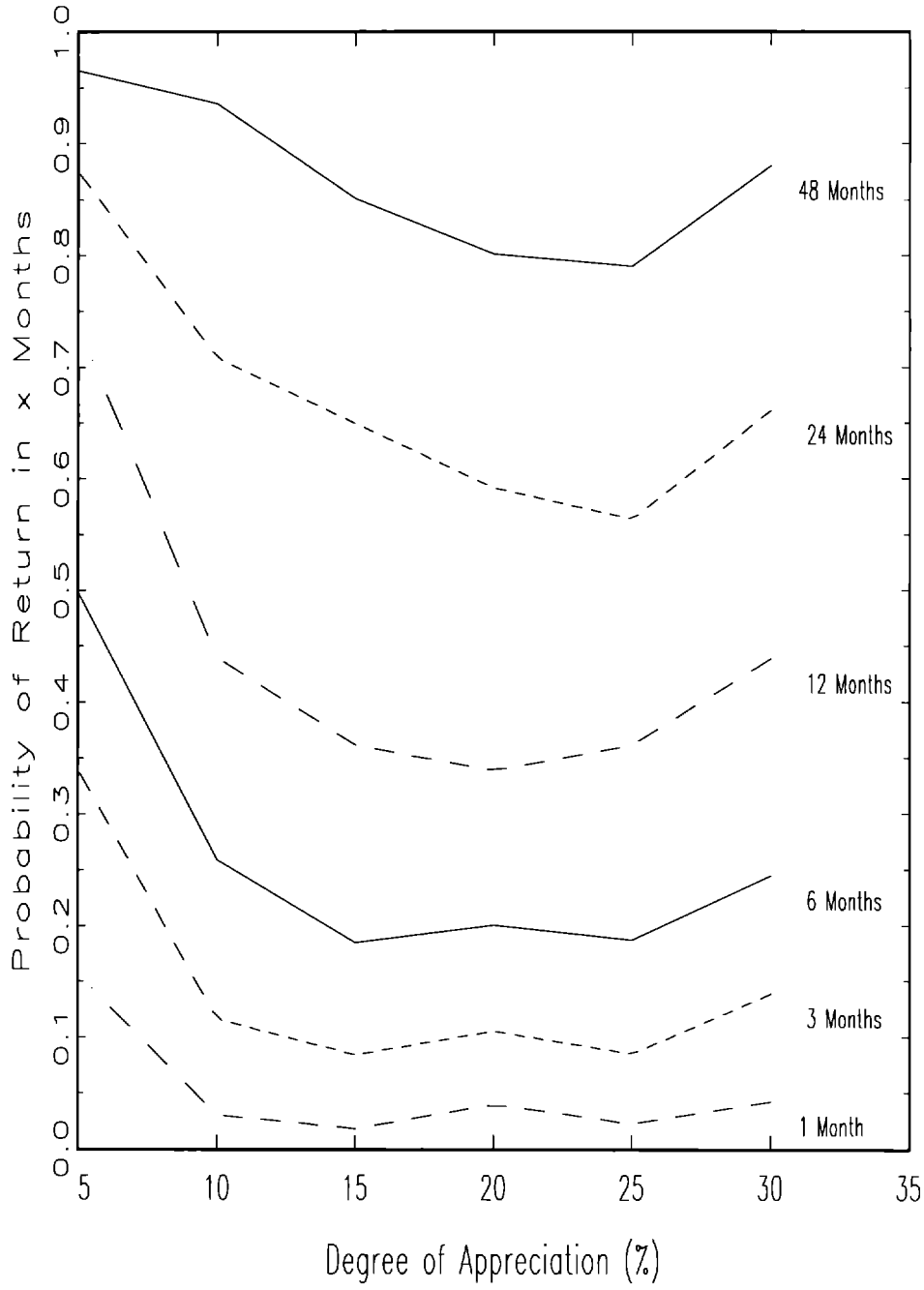

Figure 15: Degree of Appreciation and Probability of Return - Trends Only

expect that small appreciations and, therefore, with shorter distances to cover, have a higher probability of return. This is the *distance* factor and is reflected by the downward slope part of the curves. On the other hand, as the degree of appreciation deepens there are pressures that make the RER return to the equilibrium (as defined above) which will tend to increase the probability of return. Figure 15 shows that the pressures to return start to dominate when the appreciation reaches 20–25%.

The concern with appreciation episodes is not so much whether they will revert but rather how this reversion will occur. In particular, the question is whether the reversion will occur through a collapse in the nominal exchange rate as opposed to a smooth reversion. Figure 16 plots the probability of a *collapse*, defined as a return with more than 95% of the total real depreciation caused by nominal devaluation, as opposed to inflation differentials ($S \leq 0.05$ in terms of the success index). It is clear that the probability of a collapse is an increasing function of the degree of appreciation.[29] The magnitudes are important also. Taking 24 months as a benchmark, the probability of collapse increases from 0.36 to 0.57 when the degree of appreciation increases from 10% to 30%. Since we are focusing on the probability of collapse and not the broader probability of return, figure 16 in fact isolates the *pressure* from the *distance* effect (the shorter distance implies that the probability of return from a 5% appreciation is high but not that the corresponding probability of collapse is higher). Therefore, figure 16 in general does not show U-shaped curves.

We repeat the exercise using the episodes obtained from the second definition of equilibrium RER (controlling for fundamentals). The transition matrices shown in table 8 and the probabilities plotted in figures 17 and 18 are very similar to the ones described above. There are minor differences between figures 17 and 18 and the corresponding 15 and 16. First, the U-shaped curves are more pronounced when we control for fundamentals. Also, since the overall duration of the episodes when we control for fundamentals is shorter (see description in the previous section), the 24 month schedule does not have a U-shaped form (the probability of reversal is close to 1 for any degree of appreciation). Figure 18 shows an even steeper slope for the probability of collapse as a function of the degree of appreciation (see the 24 and 48 month schedules).

[29] Here each month of an episode corresponds to an observation. Before, in subsection 4.1.2, each episode was an observation.

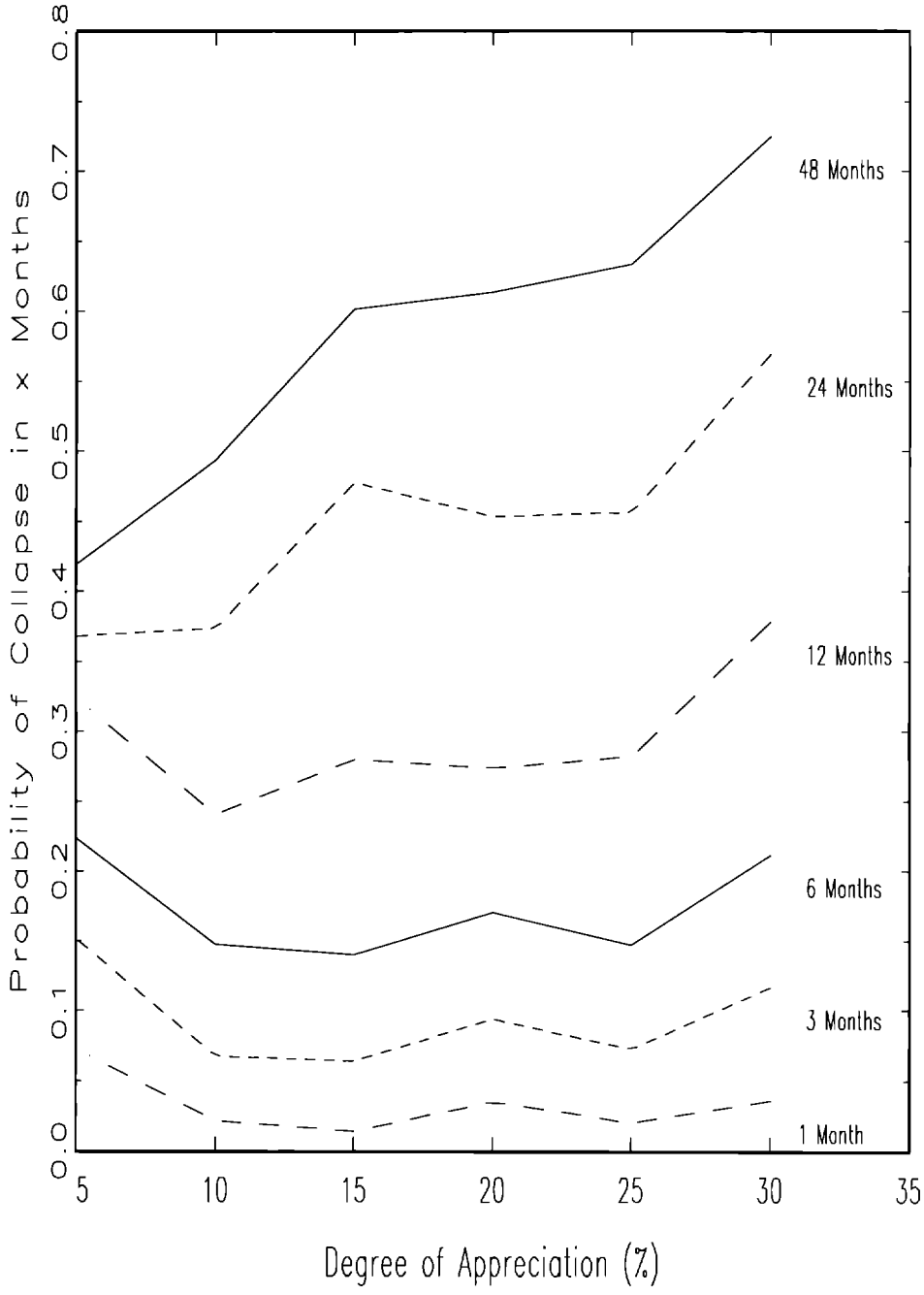

Figure 16: Degree of Appreciation and Probability of Collapse - Trends Only

Table 8: Transition Matrices of Appreciations - 6 and 12 Months

RER After Fundamentals
Appreciation Threshold = 15%

6 Months Matrix

RER Appreciation in t+6 months

	30+	30-25	25-20	20-15	15-10	10-5	5-
30+	0.26	0.04	0.05	0.03	0.03	0.00	0.60
30-25	0.10	0.06	0.07	0.07	0.13	0.03	0.54
25-20	0.13	0.08	0.07	0.12	0.12	0.10	0.40
20-15	0.05	0.04	0.09	0.14	0.18	0.15	0.34
15-10	0.01	0.01	0.02	0.07	0.24	0.23	0.42
10-5	0.00	0.00	0.01	0.03	0.10	0.21	0.65

12 Months Matrix

RER Appreciation in t+12 months

	30+	30-25	25-20	20-15	15-10	10-5	5-
30+	0.08	0.04	0.04	0.02	0.03	0.01	0.80
30-25	0.06	0.00	0.00	0.03	0.04	0.03	0.84
25-20	0.04	0.01	0.02	0.06	0.07	0.06	0.73
20-15	0.03	0.01	0.04	0.05	0.13	0.12	0.63
15-10	0.02	0.01	0.02	0.03	0.11	0.16	0.66
10-5	0.02	0.01	0.01	0.03	0.01	0.03	0.90

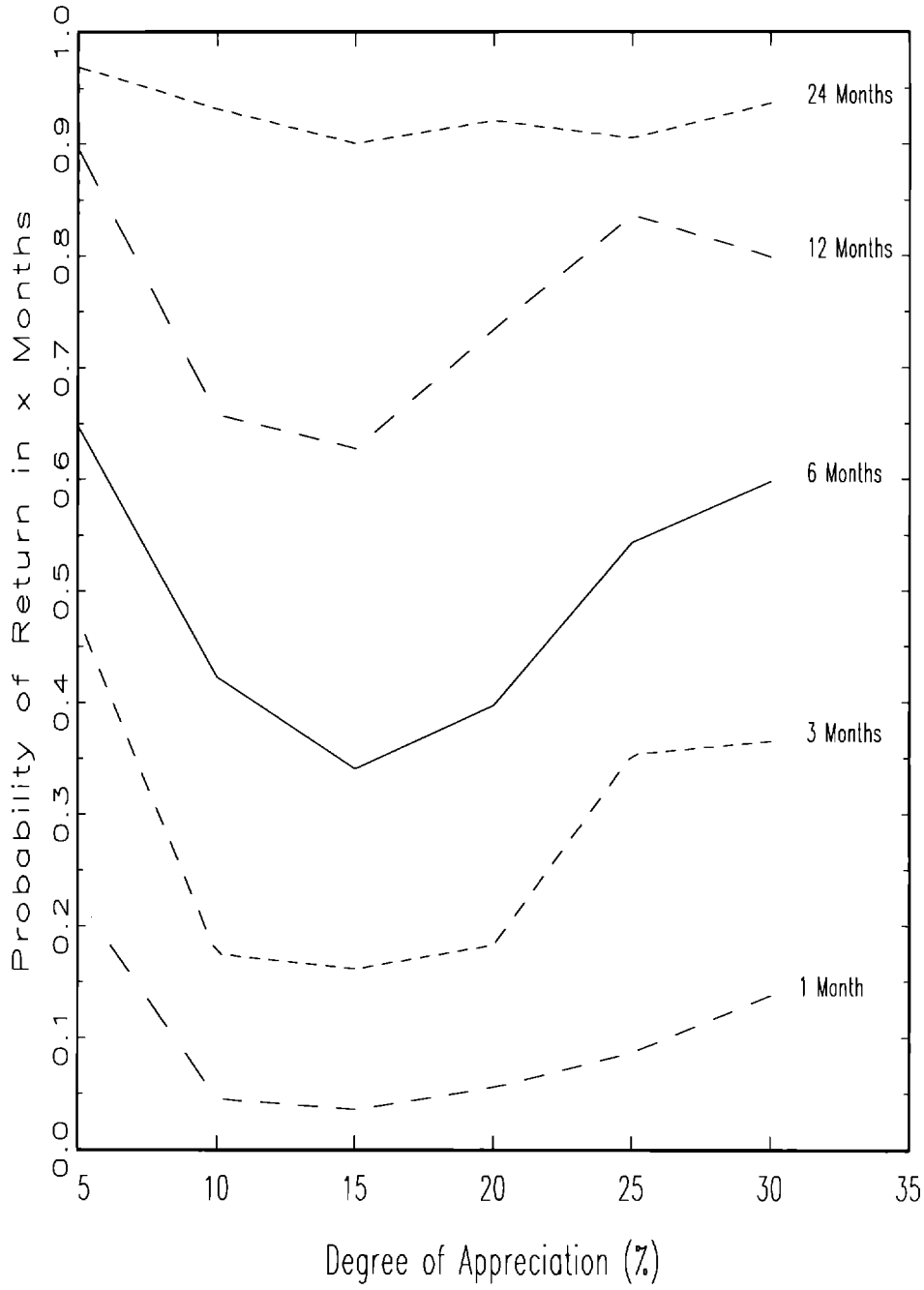

Figure 17: Degree of Appreciation and Probability of Return - Fundamentals

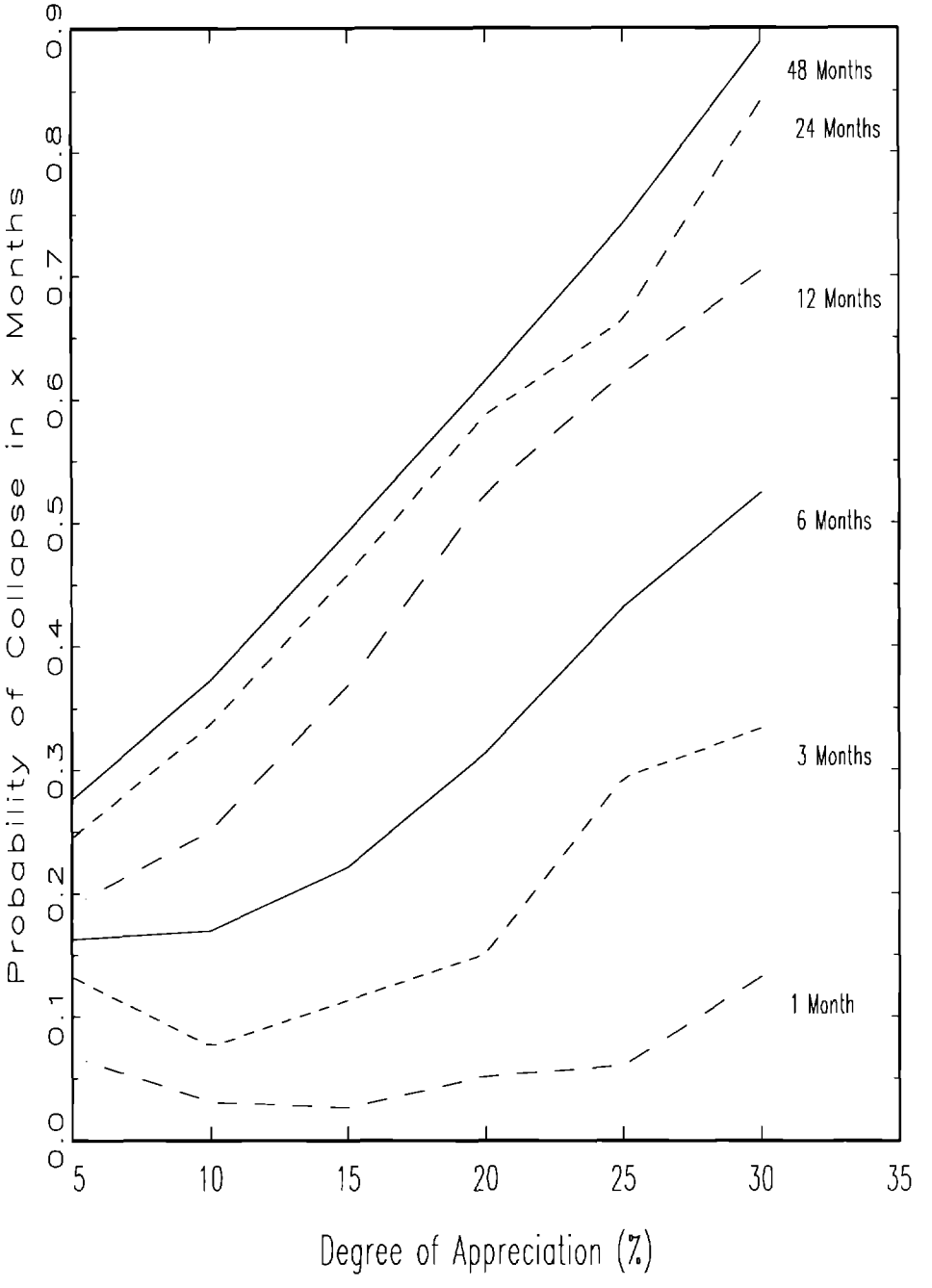

Figure 18: Degree of Appreciation and Probability of Collapse - Fundamentals

Subsampling We calculated the previous transition matrices and probability of collapse using specific subsamples of our data. First, we divided our sample between 1960–79 and 1980–94. There are no significant differences between the two subperiods. Second, we divided our sample between fixed and flexible regimes (the latter including a few cases of floating regimes). As expected, most of the results are driven by fixed exchange regime episodes. Flexible regime overvaluation episodes do not reproduce the steep upward sloping feature for the probability of collapse (as in figure 16).

6 Conclusions

After the European and Mexican exchange rate crises during the fist half of the 90's, several studies have advanced the hypothesis that the level of the real exchange rate is important in explaining future devaluations and collapses.[30] This paper calculates the probability of devaluation for various levels of real exchange rate looking at a sample of 93 countries and tries to identify all the appreciation episodes during the last 35 years (1960–1994).

The results show that it is relatively unlikely to smoothly undo appreciations greater than 25%. In our sample, only 10% of the cases had a devaluation and collapse-free return. This probability falls as we concentrate in even more appreciated cases. There are no successful cases for appreciations larger than 35%.[31]

The paper also presents transition matrices for the appreciation episodes. They show inertia in the real exchange rate for short periods of time: the RER tends to stay overvalued and at relatively the same level for 3 to 6 months. More importantly, they also show that, in a given period of time, it is much more probable to undo *completely* the appreciation than to return the long-run equilibrium value only partially. This suggests that appreciations end abruptly and do not have a smooth return, at least in very appreciated cases. The transition matrices also focus on the probability of collapse (excluding small and medium nominal devaluations). Taking a 24 month horizon as a benchmark, the probability of collapse increases from 0.36 to 0.57 when

[30] See references in section 1.

[31] The benchmark here is cases chosen with an appreciation threshold of 25% controlling for fundamentals.

the degree of appreciation increases from 10% to 30%.

As a by-product the paper also characterizes the appreciation cases. We show that appreciations have a longer duration in the build-up than in the return phase and are more likely to occur in fixed exchange regimes and during the last part of our sample period, in particular in the early 80's.

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A Further Results

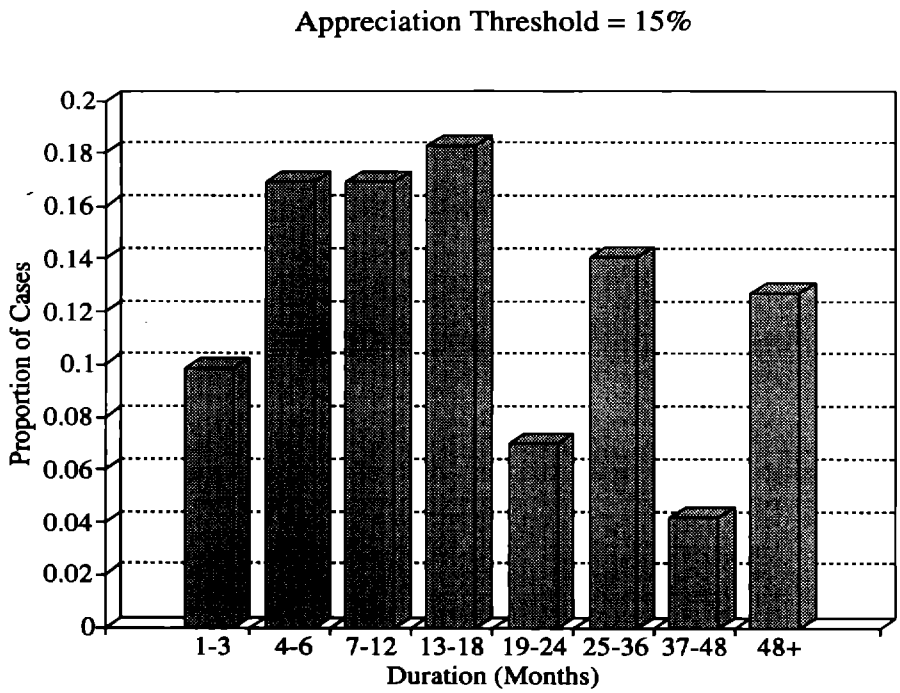

Figure 19: Histogram of Duration - Trends Only

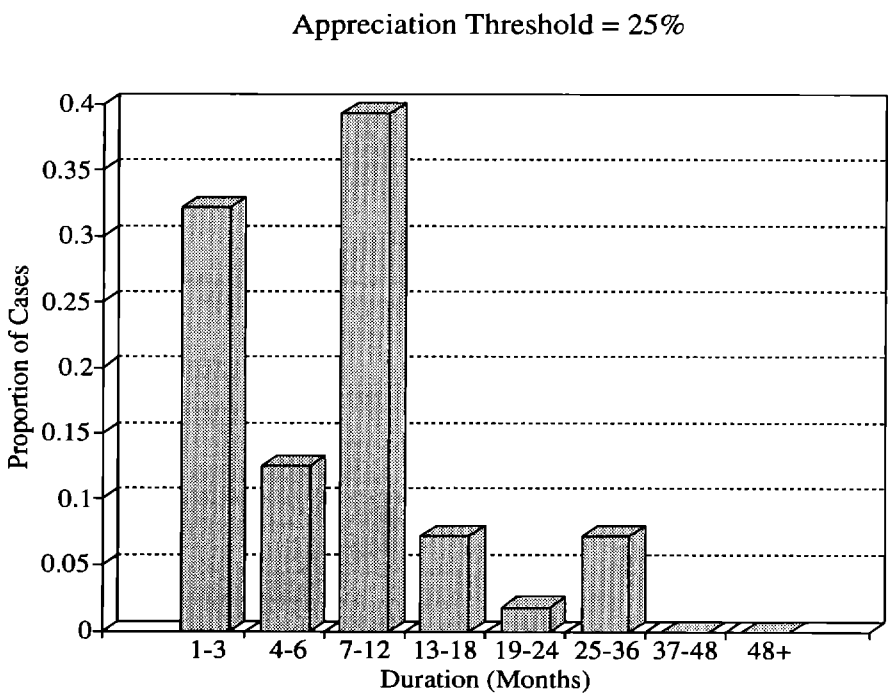

Figure 20: Histogram of Duration - Fundamentals

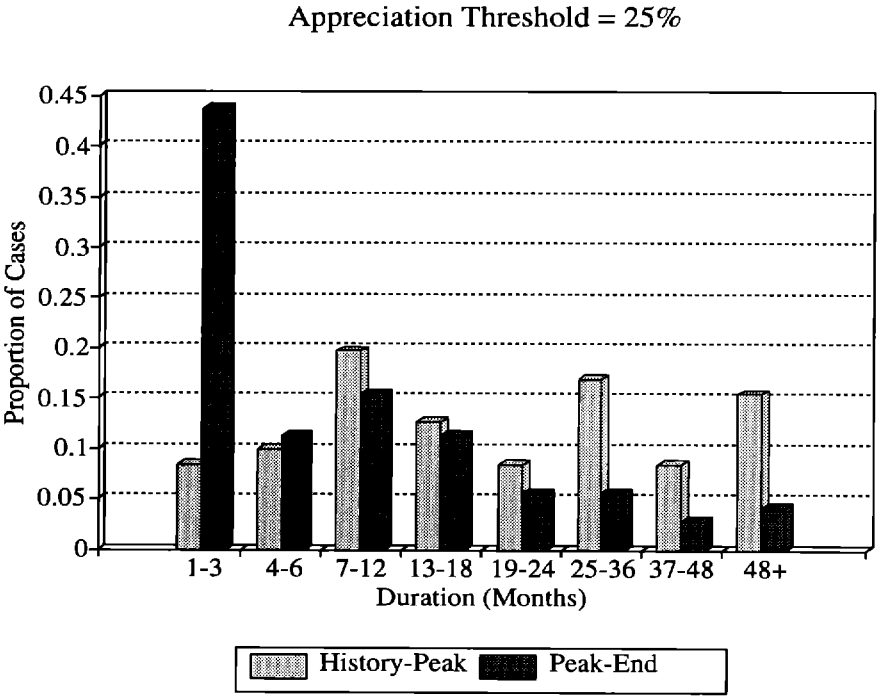

Figure 21: Phases Duration - Trends Only

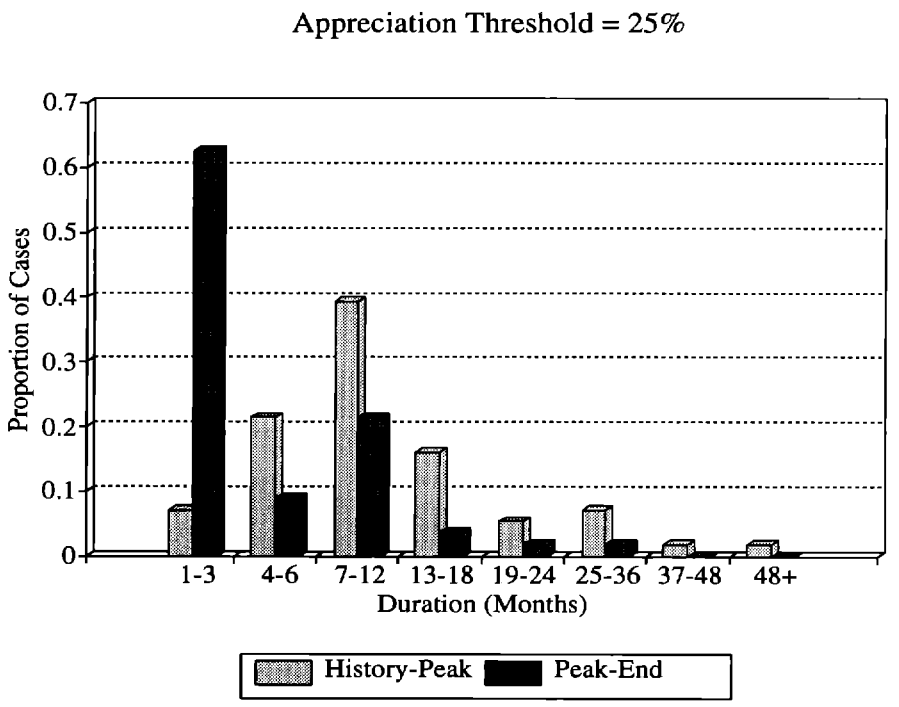

Figure 22: Phases Duration - Fundamentals

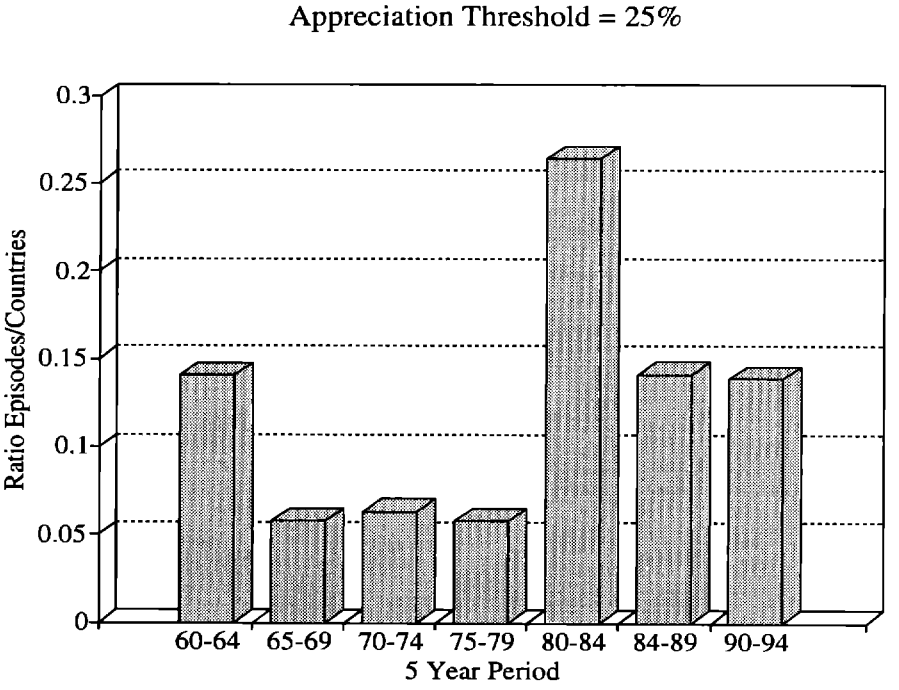

Figure 23: Temporal Distribution - Trends Only

Table 9: Transition Matrices of Appreciations - 24 and 48 Months

Detrended RER
Appreciation Threshold = 15%

24 Months Matrix

RER Appreciation in t+24 months

	30+	30-25	25-20	20-15	15-10	10-5	5-
30+	0.22	0.02	0.05	0.01	0.02	0.01	0.66
30-25	0.15	0.05	0.08	0.07	0.04	0.04	0.56
25-20	0.09	0.05	0.09	0.06	0.07	0.05	0.59
20-15	0.04	0.05	0.06	0.06	0.07	0.07	0.65
15-10	0.02	0.03	0.03	0.05	0.09	0.08	0.71
10-5	0.02	0.01	0.02	0.02	0.03	0.03	0.87

48 Months Matrix

RER Appreciation in t+48 months

	30+	30-25	25-20	20-15	15-10	10-5	5-
30+	0.06	0.01	0.01	0.02	0.01	0.01	0.88
30-25	0.07	0.01	0.05	0.04	0.02	0.02	0.79
25-20	0.04	0.02	0.04	0.02	0.04	0.03	0.80
20-15	0.03	0.03	0.03	0.02	0.02	0.02	0.85
15-10	0.03	0.01	0.00	0.00	0.00	0.01	0.94
10-5	0.03	0.00	0.00	0.00	0.00	0.00	0.97

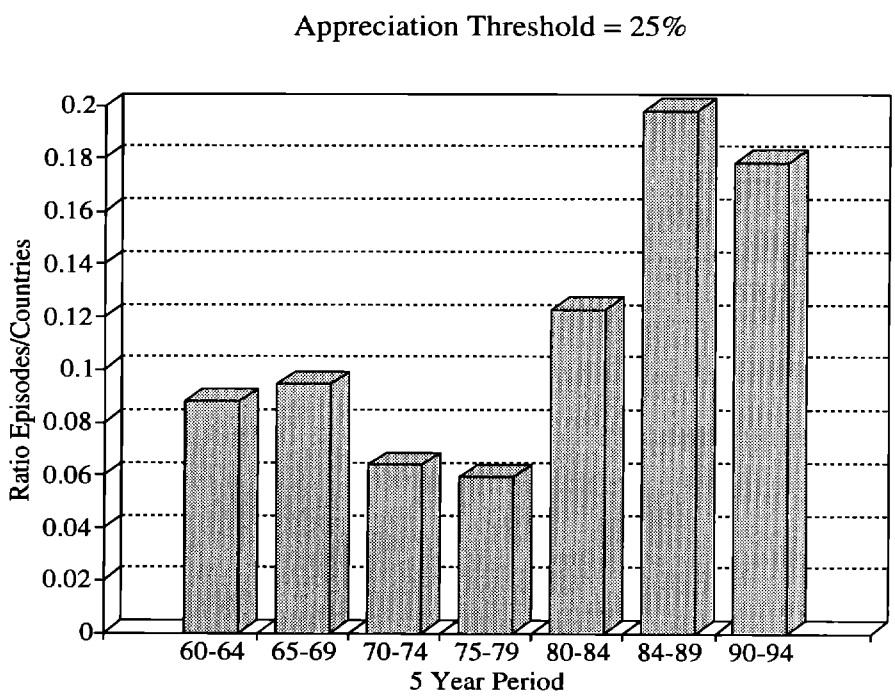

Figure 24: Temporal Distribution - Fundamentals

B Exchange Arrangements Description

We classify exchange arangements along two dimension using the following coding:

Exchange Arrangements
1. Peg to American Dollar
2. Peg to British Pound
3. Peg to French Franc
4. Peg to other currency (flagged)
5. Peg to SDR
6. Cooperative arrangements (e.g. EMS)
7. Peg to basket (incl. frequent adjustments)
8. Managed floating and other flexible arrangements
9. Free floating

Dual-Multilateral Arrangements
0. Unique exchange rate for trade transactions
1. One or more rates for trade transactions

We consider arrangements 1 to 6 as fixed regimes, 7 and 8 as flexible, and 9 as floating. Table 10 presents the distribution of the proportion of each of these aggregates, while table 11 presents the distribution of the 9 types of regime and the proportion of dual and multiple exchange rate arrangements.

Table 10: Exchange Arrangements - 3 Aggregates
Proportion of Each Aggregate in Population

Regime	60–64	65–69	70–74	75–79	80–84	85–89	90–94
Fixed	0.98	0.97	0.90	0.65	0.53	0.47	0.42
Flexible	0.01	0.03	0.07	0.29	0.40	0.45	0.46
Float	0.01	0.00	0.03	0.06	0.07	0.09	0.12

Table 11: Exchange Arrangements - Original Classification
Proportion of Each Type in Population

Regime	60–64	65–69	70–74	75–79	80–84	85–89	90–94
1	0.78	0.77	0.64	0.37	0.26	0.21	0.18
2	0.07	0.07	0.08	0.03	0.00	0.00	0.01
3	0.11	0.11	0.13	0.11	0.10	0.10	0.10
4	0.01	0.01	0.01	0.01	0.00	0.01	0.01
5	0.01	0.01	0.01	0.05	0.08	0.06	0.02
6	0.00	0.00	0.03	0.08	0.09	0.09	0.10
7	0.00	0.00	0.02	0.12	0.13	0.12	0.12
8	0.01	0.03	0.05	0.17	0.27	0.33	0.34
9	0.01	0.00	0.03	0.06	0.07	0.09	0.12
Dual	0.14	0.16	0.20	0.16	0.18	0.20	0.14

C Initial Sample

This appendix describes the initial sample of countries, data coverage for each country, original frequency of series, and the price index used in the construction of the RER.

Country			Price Index	Original Frequency	RER Coverage
1	Austria	AUT	WPI	Monthly	60–94
2	Belgium	BEL	CPI	Monthly	60–94
3	Denmark	DNK	WPI	Monthly	60–94
4	Finland	FIN	WPI	Monthly	60–94
5	France	FRA	CPI	Monthly	60–94
6	Germany	GER	WPI	Monthly	60–94
7	Greece	GRC	WPI	Monthly	60–94
8	Hungary	HUN	WPI	Monthly	68–94.6
9	Ireland	IRL	WPI	Monthly	60-9-4.10
10	Italy	ITA	WPI	Monthly	60–94
11	Netherlands	NLD	WPI	Monthly	60–94
12	Norway	NOR	WPI	Monthly	60–94
13	Poland	POL	WPI	Monthly	80–94
14	Portugal	PRT	CPI	Monthly	60–94
15	Romania	ROM	CPI	Monthly	81–94
16	Spain	SPA	WPI	Monthly	60–94
17	Sweden	SWE	CPI	Monthly	60–94
18	Switzerland	SWT	WPI	Monthly	60–93.5
19	Turkey	TUR	CPI	Monthly	69–94
20	UK	UKG	WPI	Monthly	60–94
21	Argentina	ARG	WPI	Monthly	60–94
22	Bolivia	BOL	CPI	Monthly	60–94
23	Brazil	BRA	WPI	Monthly	60–94
24	Canada	CAN	WPI	Monthly	60–94
25	Chile	CHL	WPI	Monthly	60–94

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Country			Price Index	Original Frequency	RER Coverage
26	Colombia	COL	WPI	Monthly	60–93
27	Costa Rica	CRI	WPI	Monthly	60–94.1
28	Ecuador	ECU	WPI	Monthly	75–94
29	El Salvador	SLV	WPI	Monthly	60–94.10
30	Guatemala	GTM	CPI	Monthly	60–94.10
31	Haiti	HTI	CPI	Monthly	60–94
32	Honduras	HND	CPI	Monthly	60–94
33	Jamaica	JAM	CPI	Monthly	60–94
34	Mexico	MEX	WPI	Monthly	60–94
35	Paraguay	PRY	WPI	Monthly	60–94.4
36	Peru	PER	CPI	Monthly	60–94
37	Trinidad & Tobago	TTO	CPI	Monthly	60–94.10
38	US	USA	WPI	Monthly	60–94
39	Uruguay	URY	CPI	Monthly	60–94
40	Venezuela	VEN	WPI	Monthly	60–94
41	Australia	AUS	WPI	Monthly	60–94
42	Indonesia	IDN	CPI	Monthly	71–94
43	New Zealand	NZL	CPI	Quarterly	60–94
44	Papua New Guinea	PNG	CPI	Quarterly	71–94
45	Bahrain	BHR	CPI	Monthly	75.7–94
46	Bangladesh	BGD	CPI	Monthly	74.7–94
47	China	CHN	Infl.	Monthly	69.3–94.9
48	Hong Kong	HKG	CPI	Monthly	69.3–94.9
49	India	IND	WPI	Monthly	60–94
50	Iran	IRN	WPI	Monthly	60–94
51	Israel	ISR	WPI	Monthly	68–94
52	Japan	JAP	WPI	Monthly	60–94.9
53	Jordan	JOR	CPI	Monthly	76–94
54	Korea	KOR	WPI	Monthly	60–94
55	Kuwait	KWT	WPI	Monthly	73–9.6

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Country			Price Index	Original Frequency	RER Coverage
56	Malaysia	MYS	CPI	Monthly	60–94
57	Nepal	NPL	CPI	Monthly	63.7–94.6
58	Pakistan	PAK	WPI	Monthly	61.7–94
59	Philipines	PHL	WPI	Monthly	60–94
60	Saudi Arabia	SAU	CPI	Monthly	80.2–94
61	Singapore	SGP	CPI	Monthly	60–94
62	Sri Lanka	SLK	CPI	Monthly	60–94
63	Syrian Arab Rep.	SYR	WPI	Monthly	60–94.9
64	Thailand	THA	WPI	Monthly	60–94
65	Algeria	ALG	CPI	Monthly	74–94
66	Burkina Faso	BFA	CPI	Monthly	60–93
67	Burundi	BDI	CPI	Monthly	74–94
68	Cameroon	CMR	CPI	Monthly	68–90.9
69	Central Africa.Rep.	CAF	WPI	Monthly	65–94.7
70	Congo	COG	CPI	Monthly	64–94.7
71	Egypt	EGY	WPI	Monthly	60–94.11
72	Ethiopia	ETH	CPI	Monthly	66–94.10
73	Gabon	GAB	WPI	Monthly	63–94.6
74	Ghana	GHA	WPI	Monthly	63–94.9
75	Ivory Coast	IVC	CPI	Monthly	60–94.9
76	Kenya	KEN	CPI	Monthly	68–94.2
77	Liberia	LBR	CPI	Monthly	68–90.6
78	Madagascar	MDG	CPI	Monthly	64–94
79	Malawi	MWI	CPI	Monthly	80–94.7
80	Morocco	MAR	CPI	Monthly	60–94
81	Niger	NER	CPI	Monthly	68–94
82	Nigeria	NGA	CPI	Monthly	60–94.9
83	Rwanda	RWA	CPI	Monthly	65.4–93
84	Senegal	SEN	CPI	Monthly	68–94.9
85	Sierra Leona	SLE	CPI	Monthly	86.10–94.9

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Country			Price Index	Original Frequency	RER Coverage
86	Somalia	SOM	CPI	Monthly	63.10–89.11
87	South Africa	SAF	WPI	Monthly	60–94
88	Sudan	SDN	CPI	Monthly	60–94.6
89	Togo	TOG	WPI	Monthly	70–93
90	Tunisia	TUN	CPI	Monthly	87.7–94
91	Zaire	ZAR	Infl.	Monthly	63–94
92	Zambia	ZMB	CPI	Monthly	67.4–94
93	Zimbabwe	ZWE	CPI	Monthly	78–94

D Trade Weights

	Trade Partners														
	USA	JAP	GER	FRA	ITA	SPA	UKG	NLD	ARG	BRA	SAF	SAU	SGP	AUS	Others
BEL	.06		.33	.26			.12	.23							
DNK	.10		.37	.10			.16	.05							.22
FIN	.13	.06	.29	.07			.18								.27
FRA	.13		.34		.21		.15								.17
GER	.12	.06		.22	.16		.13	.16							.13
GRC	.05	.05	.35	.14	.26		.10	.05							
HUN			.51		.09										.41
IRL	.16	.04	.14	.08			.54	.04							
ITA	.12		.38	.29		.05	.11	.05							.01
NLD	.08		.39	.14	.05		.13								.21
NOR	.12		.21	.08			.29								.30
POL			.63		.11		.18								.08
PRT	.06		.30	.26	.12	.26									.01
ROM	.13		.49		.19							.18			
SPA	.12		.26	.30	.18		.14								
SWE	.17		.34				.18								.31
SWT	.11		.45	.17	.16		.10								
TUR	.19		.41	.12	.17		.11								
UKG	.24		.29	.20	.11			.16							
ARG	.36	.05	.15					.12		.31					
BOL	.33	.08					.10		.29	.20					
BRA	.51	.17	.16					.09	.08						
CAN	.92	.08													
CHL	.36	.25	.18						.07	.14					
COL	.68	.11	.14												.07
CRI	.75	.06	.13												.06
ECU	.68	.09	.08					.09		.06					
SLV	.57		.20												.23
GTM	.76	.07	.11												.07
HTI	.81			.06	.03			.06							.04
HND	.81	.10	.08												
JAM	.57						.15	.07							.21
MEX	.84	.06	.06			.04									
PRY	.15	.13						.13	.16	.42					
PER	.52	.15	.14						.09	.10					
TTO	.87						.08								.05
USA		.35	.09				.09								.47
URY	.18		.13						.19	.50					
VEN	.82		.13					.05							
AUS	.37	.44					.10								.08
IDN	.22	.58	.09										.11		
NZL	.25	.26	.05				.12							.32	
PNG	.09	.34											.09	.40	.09
BHR	.10	.07					.08					.74			
BGD	.44	.15	.07		.09		.09								.16
CHN	.16	.23	.04												.57
HKG	.26	.18	.05												.50
IND	.31	.20	.19				.16					.07			.08
IRN		.21	.45		.19		.15								
ISR	.44		.17		.06		.15								.18
JAP	.66		.14												.20
JOR	.31		.10	.09			.10					.17			.22
KOR	.54	.46													
KWT	.21	.21	.13		.09		.10					.26			

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	Trade Partners														
	USA	JAP	GER	FRA	ITA	SPA	UKG	NLD	ARG	BRA	SAF	SAU	SGP	AUS	Others
MYS	.31	.36											.33		
NPL	.28	.11	.26	.04			.05						.21		.06
PAK	.35	.27	.20				.10					.08			
PHL	.54	.36	.09												
SAU	.42	.33	.07		.06		.12								
SGP	.36	.28										.05			.32
SLK	.53	.28	.10				.09								
SYR	.14		.11	.32	.35							.08			
THA	.34	.50											.15		
ALG	.22		.08	.29	.24	.05		.07							.05
BFA		.06	.20	.41	.02			.03							.28
BDI		.26	.17	.27											.29
CMR	.12	.04	.11	.47		.04		.07							.15
CAF		.05	.03	.51											.40
COG	.16			.57	.16	.05		.06							
EGY	.67	.07	.06		.05			.09		.06					
ETH	.13	.26	.32		.20		.09								
GAB	.26	.05	.04	.60		.05									
GHA	.20	.14					.48	.08							.10
IVC	.07		.13	.42				.22							.16
KEN	.07	.15	.22	.08			.39								.10
LBR	.32	.04	.34	.07	.13										.10
MDG	.17	.13	.15	.56											
MWI	.09	.14	.12				.28				.36				
MAR	.06		.11	.53	.13	.17									
NER	.07	.04	.05	.60		.04									.20
NGA	.42	.06	.16	.06	.08	.11	.10								
RWA		.10	.14	.12											.64
SEN	.05			.65	.13										.17
SLE	.29	.08					.27	.19							.17
SOM			.04		.26		.05					.65			
SAF	.30	.24	.22				.24								
SDN	.09	.07	.09		.07		.13					.32			.23
TOG	.06		.06	.43	.06	.07		.10							.22
TUN	.04		.21	.41	.28										.05
ZAR	.30		.07	.12	.06					.13					.32
ZMB	.08	.32	.10	.11			.14				.15	.05			.05
ZWE	.16	.05	.18				.20				.40				